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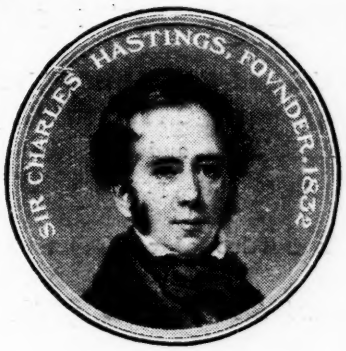

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CORYTONE

NINETIETH ANNUAL MEETING
OF THE
British Medical Association.
Held at Glasgow, July, 1922.

PROCEEDINGS OF SECTIONS.

SECTION OF PUBLIC HEALTH.
A. K. CHALMERS, M.D., F.R.F.P.S., D.P.H., President.

PRESIDENT'S INTRODUCTORY REMARKS.

1888–1922:
A PLEA FOR THE STUDY OF BIOLOGY IN RELATION TO PUBLIC HEALTH.

A DESIRE to review the history of medicine in its preventive aspects during the thirty-four years which have come and gone since last our Association met in Glasgow is almost inevitable. But that it can be done adequately in the time at my disposal would require a power of focusing for which I claim no qualification. My purpose rather is to indicate a few contrasts; to ask how far the years between have established the views of our predecessors; whether the horizon has lifted and disclosed objectives hidden from them; most of all, to ask whether the same spirit of service which inspired our predecessors remains with us who aspire to follow them. A comparison of the record of subjects discussed at the former meeting with those of the present might alone supply the answers.

PUBLIC HEALTH THIRTY YEARS AGO: A CONTRAST.

Illustrations of the contrasts are readily found. The mean population of Scotland during the eighties decade was 3,880,610; at the last census it was fully a million more. In the former period the average death rate was 19 per 1,000. Had this rate obtained in recent years, we should have had almost 20,000 more deaths annually than were registered during the period 1916–20, although these included periods of pandemic influenza of great intensity. The large towns of Scotland have now (1916–20) a lower average annual death rate (16.34 per 1,000) than had the rural districts and smaller town areas in the later eighties (17.28 per 1,000).

The infant mortality during the eighties rose from 112 per 1,000 births in 1881 to 130 in 1890; during the last ten years the highest rate was 126 (in 1915), in 1920 it fell to 92, and was 97 and 99.8 in 1916 and 1918. But the birth rate has also fallen from an average of 32 during the eighties to 25.4 in the years 1911–15 and 22.7 in 1916–20. One result of this is that already by 1911 the proportion of the population over 15 had increased from 63 to almost 68 per cent. In other words, that portion of the population which has a steadily although at first slowly increasing death rate, is gradually increasing in volume, so that it now forms fully two-thirds of the whole.

Further contrasts may be drawn from the field of epidemic diseases. I need not recall the shrinkage in what were then called the major infections which has run parallel with these changes. The recurring prevalences of typhus fever, which formed so marked a feature of the epidemic history of the middle of last century, had largely ceased by the eighties decade, but even so it caused about 90 deaths annually in the years 1886–90; while in recent years (1916–20) the deaths averaged only one-tenth of that number, notwithstanding the great prevalence of the disease in Eastern Europe and Russia and in the Balkans during the war years and afterwards, and the many migrations both of soldiers and civilians determined by the war. Again, the deaths from enteric fever, which averaged 765 annually in the period 1886–90 and in three earlier years of the decade had exceeded 1,000, now average only just over 100 annually (109); in the former period over 7,000 deaths were on an average ascribed annually to pulmonary tuberculosis—now less than 5,000. Scarlet fever is less fatal, but its prevalence oscillates through long intervals; while measles and whooping-cough seem unaffected by any measures hitherto undertaken for their control.

Passing for a moment from results to machinery and equipment, there was in those days no county sanitation—no general provision of hospital accommodation for infectious diseases—a limitation, indeed, of the term "infectious disease" to the acute specific fevers and exanthemata. There was no Notification Act of general application; bacteriology was in its infancy; vaccine and serum therapy had to wait some years before their unrolment began. The part played by insects in the spread of disease was almost unsuspected.

The first Public Health Act for Scotland had already been twenty-one years on the Statute Book, but the sanitary enfranchisement of the rural populations was not yet accomplished, while the burghs were struggling with conditions for which the general Act provided no adequate remedy. So sanitary legislation formed the theme of the President, Sir Henry Littlejohn, and the late Sheriff Spens urged the creation of a Minister of Health. County sanitation became possible with the passing of the Local Government (Scotland) Act of 1889, and a Burgh Police and Public Health Act in 1892 gave a new stimulus to the sanitation of towns. The Housing Act of 1890 had barely begun to form round the nuclei supplied by the Torrens, Shaftesbury, and Cross Acts and some local ones of earlier years.

In another direction the horizon was limited by our insular position. Exotic disease in the form of cholera, it is true, had reached our shores so recently as 1866, and although the Venice Convention dated from 1857 it was not until 1900 that a limited outbreak of plague among our own people startled us out of our insular complacency and helped to stimulate the formation of port local authorities as a means of protecting our shores against sea-borne disease. More than all, and of special importance in view of the future, preventive medicine broke through the old barrier of insanitary surroundings and insisted on regarding the individual as himself the contributor to much of the disease which imperils our well-being, and brought venereal disease within the purview of administrative action.

THE FRUITS OF ADMINISTRATIVE ACTION.

One field after another has thus been brought within the scope of regulated effort, and may claim some consideration at least in a review of the causes of the decline in the death rate which has gone on contemporaneously with their application to administrative purposes. But when we endeavour to assess the precise value of any individual factor when many are operating, error may readily occur. Legislation and administrative effort are valuable adjuncts, but they are not the only factors which control disease. How, for example, are we to explain one of the profoundest problems in the history of tuberculosis in this country? I mean the sudden change in the direction of the death rate which took place in Scotland in the middle of the seventies. For fully a decade before the last meeting of the Association here the tuberculosis death rate was undergoing reduction at a rate which is not now equalled. No concerted administrative action was being directed against its prevalence—I do not, of course, forget the early clearance schemes, but they were wholly, I think, confined to the towns, whereas the fall was general—and the subject does not, I think, occur in the published record of the former meeting. On a former occasion elsewhere[1] I endeavoured to associate the antecedent increase in the rate with the migration to the towns which was so marked in Scotland in the middle of last century, and its subsequent fall with the growth of a locally born population endowed with greater resistance to local conditions than their immigrant parents; but the lack of information regarding the actual proportion of in comers among the population somewhat altered the apparent significance of the contrast.

If I seem to labour the point it is for the purpose of asking whether, in contemplating the superstructure we erect for public health purposes, we do not too often forget that Nature is silently at work often doing better for us than we know, and that our efforts will best be directed towards the control of disease when we know more of Nature's methods of adapting life to the varied conditions under which it exists. For Nature is a skilful nurse, and our best work will be done by a close study of her methods. Tuberculosis and infant mortality, indeed, form two illustrations of the play of biological forces but dimly apprehended. To these we might well add a third in the decline of the birth rate, and the common warning I think they give is against a too ready acceptance of the view that their decline is to be ascribed solely to administrative action on the one hand, or acts of volition sometimes called prudential on the other.

In the first decade of a falling death rate it was still too early to see that a process akin to geological denudation was in progress, and it was not, indeed, until the present century had begun that a high infant mortality rate was disclosed as at once persistent and refractory. So also with regard to tuberculosis, the discovery of the bacillus was still too recent for frank recognition of its rôle as an infecting agent to influence action for the prevention of its spread. But in connexion with both it is worth remembering that the fall in the general death rate coincided with the growth of our foreign meat imports, and that the fall in the infant death rate of this century is occurring among the children of those who grew up under the improved food conditions which these imports tended to make general.

THE NEW HORIZON.

Infant Mortality.

Since the present century began we have had in succession organized movements for the welfare of mothers and children, for the reduction of tuberculosis and the treatment of venereal disease. All of these reach down by separate channels to the roots of our social structure, but each also presents aspects which are biological before they are social. It is the recognition of this factor as influencing the whole field of preventive medicine that I think fills the future with hope. Let one but try to envisage the biochemical changes which set in directly the newly born child draws its first breath and produce within a few days closure of the ductus arteriosus and then ask himself whether Nature's alchemy is limited to this single and marvellous process by which the circulation becomes adapted to the demands of an air-breathing organism. Here the structural change is concrete and obvious, as is the alteration in physiological function which accompanies and depends on it. And if we ask ourselves regarding the great volume of infant deaths ascribed to immaturity under a diversity of names (prematurity, birth debility, and some others), mainly occurring in the first weeks of post-natal life, contributing about one-third of the total infant death rate, and distributed with apparent impartiality through every social group, the closed ductus arteriosus may stand as a type of the changes which in failing cause the death of so many newly born children.

Venereal Disease.

In venereal diseases again biology and disease are curiously intertwined. Treatment centres attract many social and biological types, from the youth whose early training has failed to develop habits of self-control which should find their beginning in the physiological inhibitions of the nursery, to the habitué who presents himself with a reinfection many times repeated. If we accept the one as but a reckless adventurer on the sea of desire who wilfully discards the rudder of self-control and abandons himself to the storm winds of passion, how can we regard the other but as an atavistic "throw-back" to a much earlier civilization which looked at the marvel of reawakening nature through the eyes of the phallic worshipper? Superficially these two men may be regarded as differing only in the degree of freedom with which they permit themselves to follow antisocial practices; in reality, although both are of one generation, from the point of view of social development they are separated by some thousands of years.

Tuberculosis.

I need not in this connexion anticipate the questions which surround the administrative treatment of tuberculosis, as full scope will be afforded for discussion in the joint conference with the Tuberculosis Section to be held during our meetings. But this much may be said on the general outlook, that no completely satisfactory explanation has yet been advanced of the change in direction of the death rate from all forms of tuberculosis which began with some suddenness in the mid-seventies, before schemes for its administrative control were in operation—before, indeed, widespread effort at sanitary reform was in operation beyond the town areas. Yet the fall was general and has been continuous, and in its beginnings at least must have been the expression of causes widely operative and not confined to particular sections of the population. One looks again for a biological explanation, whether it be in a reduced virulence of the organism or in increased resistance of the population as a whole. And it is a tempting hypothesis to regard as one among several factors of wide application the new sources of nitrogenous food supply, then beginning to be widely available by the importation of foreign cattle.

It seems to me that Loeb's investigations into the production of artificial parthenogenesis have opened up an entirely new aspect of the relation of cell life to the salinity of the fluids in which it is bathed, and may be found ultimately to have some bearing on the everyday question of food supply. For the present the adequate feeding of the population seems to me one of the public health problems still awaiting solution. Actual food shortage—that is, famine—in a general sense is unlikely in these islands in peace times, but reduction below subsistence diet among great masses of the population is a possibility in times of trade depression, and our machinery for meeting this is defective.

Industrial Fatigue.

In still another direction the horizon is lifting. Of recent years an entirely new field of research has been opened up by the application of physiological and psychological tests to the discovery of the causes of industrial fatigue.

Diseases referable to particular industries have long been recognized, but the need for correlating the rhythm of the work to the physiological rhythm of the worker, if not an entirely new conception, is at least a new application of the doctrine which Collis and Greenwood aptly, I think, illustrate by the picture of a boat race where the rowers "go to pieces" if the stroke is too slow to permit of sufficiently rapid breathing, and, on the other hand, cannot breathe efficiently when the rate exceeds 40 a minute. And as the conditions on which both efficiency and fatigue depend include the housing of the worker, his food, habits, and recreations, as well as the hours and method and conditions of labour, we seem at last to be within sight of a time when employer and employed can meet on a common platform and discuss the hours and conditions of labour in the light of the physiological conditions on which maximum efficiency may be reached with a minimum of fatigue.

CONCLUSION.

In conclusion, it would be unwise to forget that many of the aims of preventive medicine come under the general criticism so often applied to all schemes of social welfare. You are familiar with the argument: Racial fertility is in inverse ratio to the human value of the stock, and much of the work of preventive medicine is preserving the inefficient. Saved from the incursion of barbarian hordes, civilization is now imperilling its own existence by preserving the unfit. We are, it is alleged, accentuating the effects of a differential decline in the birth rate by an indiscriminate preservation of many unfit lives at the other end of the social scale. Natural processes of selection, we are told, are being arrested, and we are silting up civilization from the bottom.

But biological fitness to carry the burden of civilization cuts across all social stratifications. In America, because of the enormous complexity of the social problems which immigration is producing, they are probably reaching conclusions more quickly than in this country. During the late war the United States army authorities applied "intelligence tests" to nearly one and three-quarter million recruits, and "some of the best scores were made by illiterate ignorant Southern mountaineers who had never before been outside their native valleys. In other words, primitive conditions had held back a high-grade Anglo-Saxon stock, but the intelligence was there, passed on from generation to generation, and only awaiting a favourable opportunity to display itself."

It is right to state, however, that the main thesis of the author from whom I have taken this extract is the biological decline which threatens civilization, and the volume is a reasoned statement of the evidence which the work of Galton and Whetham among others in this country has made familiar to us.[2] But the quotation is of value, I think, if it serves to stimulate us anew to think what "primitive conditions" are, and induces us to ask how much biological capital of permanent value to the race is locked up in the unfavourable environment in evidence everywhere awaiting the opportunity which it is one of the aims of preventive medicine to afford.

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PORT SANITARY ADMINISTRATION:

ITS DEVELOPMENT AND ITS RELATION TO PUBLIC HEALTH IN ENGLAND AND WALES.

BY

RICHARD J. REECE, C.B., M.A., M.D., M.R.C.P., D.P.H.,

Vice-President of the Section.

ONE of the primitive instincts of mankind is to protect itself from the possible introduction of pestilence. It is probable that in a very early period of civilization, when men first consorted together in communities, some sort of crude code existed for dealing with obviously diseased persons and outbreaks of disease with the object of preventing the spread of sickness. The best known example of such a code is given in the thirteenth and fourteenth chapters of the Book of Leviticus, which lay down the procedure for certain measures that should be carried out in regard to "lepers," and for their isolation.

As time went on and communications between countries became established and the trade of the world expanded, the adoption of methods designed to prevent the introduction of pestilence became general. These methods varied from time to time in accordance with the views that prevailed as to the manner in which disease was spread, but it was not until the middle of the nineteenth century, following the discoveries of Pasteur, Pollender, and Bavaine, that methods of "quarantine" became established on a scientific basis. The word "quarantine," although its modern practice differs materially from that of mediaeval times, is still retained to indicate those restraints placed on free intercourse on land or sea, and those measures taken to protect the public health by preventing the introduction of disease.

The first attempt to enforce maritime quarantine probably took place in Venice. In 1448 the Venetian authorities drew up a code of quarantine regulations which were directed against the introduction of plague into their city, and for centuries this code formed the basis for similar codes in other countries.

The study of the various measures adopted from time to time is an interesting one. It is, however, not possible to give a detailed account of them in this paper. Of the older methods Dr. John C. McVail wrote:

> "Regarding the prevention of plague invasion in olden times, some places adopted measures which would not be permissible in the present day. The City of Aberdeen was nothing if not thorough in this matter. As recorded by Dr. Creighton, the townsmen in 1585 followed the Draconian example of Good Queen Bess at Windsor some twenty years before. They erected three gibbets, 'ane at the mercat cross, ane other at the Brig o' Dee, and a third at the haven mouth, that in case ony infectit person arrive or repair by sea or land to this burgh, or in case ony indweller of this burgh receive, house or harbour, or give meat or drink to the infectit person or persons, the man be hangit and the woman drownit.'"

In 1636, when the fear of plague occupied the public mind of this country, the Royal College of Physicians of London drew up certain directions, the second of which states that:

> "It is likewise necessary that there be care taken that neither man nor goods may come from any suspected places without a certificate of health or else either to be sent suddenly away or to be put in the pest house (or such like place) for 40 days, according to the custom of Italy."

It is interesting to note that it was in August in this year that the distinguished Fellow of the College, William Harvey, who first described the movements of the heart and the circulation of the blood, was interned in a lazaretto at Treviso while on his way to visit the English Ambassador, Lord Basil Feilding, at Venice. His letters written from the lazaretto show how deeply he resented his detention.

It was not until 1710 that the first Quarantine Act was passed in England. Prior to this, regulations to prevent the introduction of disease into this country by placing restrictions on the free movement of persons and goods had been issued by an Order of the King in Council, and the Act of 1710 was passed hurriedly under the influence of panic occasioned by the prevalence of plague in the Baltic. It was followed by amending Acts, one of which gave power to order vessels coming from infected places, or laden with goods from such places, or having on board any infected persons, to be burnt, together with the whole or any part of the cargo. In 1752 a new Quarantine Act was passed under circumstances not associated with panic due to a prevailing epidemic. By the provisions of this Act all vessels infected with plague were required to proceed to one port—namely, New Grimsby. At that period reliance against the introduction of plague was placed on the opening out and airing of cargo, and this principle was adhered to; the landing was prohibited of goods or merchandise that had been brought from suspected areas and which had not been sufficiently opened and aired at the lazarets at certain specified places.

These quarantine regulations placed restrictions on the commerce of the country, and it was recognized by Parliament in 1752 that "the present system of quarantine by airing goods on hoys and vessels is not well calculated to prevent infection, and is inconvenient and expensive to the merchant," and later money was provided by Parliament to establish a lazaret for the performance of quarantine by persons and goods at Chetney Hill, in the county of Kent (in what is now known as Milton Rural District). This lazaret was never completed.

In 1783, plague became prevalent in Poland, and the Privy Council ordered vessels coming from that country to perform quarantine for forty days. Even in those times we were dependent to a certain extent on imported foodstuffs and some of the vessels from Poland were laden with grain. In a short time Edinburgh was threatened with a corn famine, and an order was hurriedly issued to allow vessels laden only with grain to discharge their cargoes without any quarantine restrictions, provided that the master of the vessel certified on oath that the crew of his vessel were free from infection, and that his vessel had not communicated with any vessel from an infected place.

With increasing overseas trade the impracticability of enforcing quarantine measures which seriously interfered with commerce became more and more evident, and this brought about a revision of the quarantine system. In 1824 a select committee appointed to inquire into the circumstances associated with our foreign trade drew attention to the serious financial burdens imposed on shipping by the quarantine charges, and in particular one case was cited in which there was no sickness on board the vessel yet nevertheless the quarantine charges exceeded 90 per cent. of the value of the cargo.

The report of this committee was followed by the passing of the Quarantine Act of 1825. This Act prescribed precautionary measures to prevent the introduction into this country of diseases such as plague, cholera, and yellow fever—diseases from which the country was free and which existed in countries with which we had maritime communications. Under the provisions of this Act and of the Orders in Council of the same year, all vessels coming from the Mediterranean or from the West Barbary on the Atlantic Ocean with clean bills of health, or any vessel from ports of Europe outside the Mediterranean or from America, were required to perform quarantine at various places specifically named according to the vessel's port of destination. The duration of quarantine was for fifteen days after arrival at the port or after discharge of cargo into "floating lazarets" or lighters, according to the nature of the cargo. All vessels whose bills of health were not "clean" had to perform quarantine at Standgate Creek in the Thames, or at Milford Haven. This Act remained on the Statute Book until repealed by the Public Health Act of 1896.

But long before 1896, as Dr. Bruce Low has pointed out, the Quarantine Acts had been regarded as a failure, and it was even then contended that quarantine could give but a false security for the purpose it purported to accomplish. In 1849 a suggestion was made that existing quarantine establishments should be abolished and that reliance should, in future, be placed exclusively upon the protection afforded against the spread of imported infection by a system of local sanitary improvements. From that time onwards the opinion of British sanitarians has been that the best way to prevent the dangers arising from imported infection is to maintain a high standard of sanitation and administration at our ports and inland districts, but it took the English advocates of the abolition of quarantine about twenty-five years to make any impression on other nations.

In this country maritime quarantine has been applied only to cholera, plague, and yellow fever—all three diseases of foreign origin. Against cholera the full quarantine procedure has not been enforced since 1858. Considerations of time and space do not permit of even a brief account being given of the

arguments adduced in favour of the substitution of "medical inspection" for "quarantine" and the steps taken to bring about the change.

In the year 1871 the Privy Council was succeeded as the central health authority by the newly formed Local Government Board, and in 1872 an Act was passed dividing the whole of England and Wales into urban and rural sanitary districts. The Board was given power to constitute port sanitary authorities for any customs port or for part of a customs port, and the provisions of this Act were reproduced with modifications in the Public Health Act of 1875, which consolidated and amended the various laws relating to public health in England and Wales.

The system of quarantine of ships formerly relied on to prevent the introduction of infectious disease into this country from abroad was replaced by the system of port sanitary administration so established, and by subsequent legislation. Under these various Public Health Acts every local sanitary authority whose district abuts on any part of the coast or on a navigable river is a riparian authority. Under Section 287 of the Public Health Act, 1875, the riparian authorities of the principal customs ports have been constituted port sanitary authorities by Order of the Local Government Board either singly or as joint boards. The expenses of the port sanitary authorities are met in the same manner as those of local authorities under the Public Health Acts. The London Port Sanitary Authority was established by a separate enactment.

It should be understood that the coastline of England is divided into several customs ports, and in a customs port may be comprised one or more port sanitary districts, or other sanitary districts not included in a port sanitary district. These other sanitary districts may be urban or rural, and are known for administrative purposes as riparian sanitary districts. In all customs ports there are boarding stations, appointed by the Commissioners of Customs and Excise, at which ships arriving from "foreign" are required to bring to for boarding by customs officers. The precise position of the official boarding station of the customs is clearly defined at each port. There are usually two such boarding stations at each port, one being "for vessels infected" or "suspected," as defined in Article I, Part I, of the Order of the Local Government Board, dated September 9th, 1907—to which is sometimes added "and vessels with dangerous infectious disorders on board," and the other "for all other vessels." By the latter is meant the place where the vessel is bound for discharge of cargo or passengers and for loading. In practice, vessels which are known and admitted by the master to be "infected" or "suspected" bring to at the customs boarding station. In other instances the port medical officer of health may inform the customs that he wishes to inspect vessels coming from certain ports or places where infectious diseases are prevalent, and in such circumstances the vessels are intercepted at the boarding station by the customs and detained for examination by the port medical officer of health. Otherwise the vessel goes straight to her place of "mooring, discharge or loading."

The port sanitary authorities exercise over the waters of the port and over the shipping therein the same functions as sanitary authorities exercise on land, with certain additional duties; and for the purpose of carrying them out all port sanitary authorities must appoint a medical officer of health and a sanitary inspector, and if necessary assistant sanitary inspectors, some of whom must have special qualifications as food inspectors, and provide isolation hospital accommodation for cholera, plague, small-pox, and other infectious diseases, either directly or by arrangement with other local authorities.

Cholera, *plague*, *typhus fever*, and *small-pox* are four among many diseases that may be introduced into the country from abroad through the agency of shipping. The far-reaching effects of the great war have extended to and influenced the prevalence and distribution in the world of these four diseases; the study of their behaviour under war conditions and afterwards is receiving the earnest attention of epidemiologists. We realize that these conditions have placed this country in a position that renders it more liable than usual to the introduction of disease.

It is known that *cholera* has established itself for the time being in certain parts of Russia and the Ukraine. The presence of this disease in Asia, or even in Europe in the neighbourhood of the Black Sea, has not in the past been a source of more than potential danger to this country. The short incubation period of cholera, the long sea passage through the Mediterranean Sea, or even the overland route finishing with a short sea voyage to this country, afford ample time for travellers to develop symptoms of the malady before reaching this country. It is a different matter when cholera appears in Europe in the area of the littoral of the North and Baltic Seas.

The circumstances of the war have led to the spread of lice-borne diseases, and at the present time there is widespread prevalence in Europe of these diseases. Of these the most important is *typhus fever*. Recently a man coming from Warsaw developed the disease immediately after his arrival in London, and cases of typhus fever have occurred in Birkenhead. But at the moment there is no typhus fever in England, and it will be realized that the increase of traffic with typhus-infected countries renders very strict precautions necessary to maintain this freedom.

Small-pox was present in many of the war zones and in the armies; and incidentally the civil population in these zones experienced attacks of small-pox limited in proportion to the extent of their protection by antecedent vaccination. Previous to the war this country had little fear of the possible introduction of small-pox through the agency of returning soldiers; for, in the past, British troops were vaccinated or revaccinated on joining the colours. During the war vaccination or revaccination was not made compulsory on men of the Territorial Force or of the new army; though the great bulk of our soldiers, owing to their common sense, willingly accepted this protection against small-pox. Nevertheless, this protection was not adopted by all, and, during the year 1919, outbreaks of small-pox occurred in England and Wales which were traced directly to returned soldiers.

The possibility of the introduction of *plague* through human cases is not very great; its introduction is more likely to occur through infected rats, brought on vessels to our ports, gaining access to the shore and conveying the infection to the rat population on land. The revision of the International Convention may have the effect of extending the duties of port sanitary authorities in the direction of rat destruction.

In addition to the four diseases already mentioned there are others intimately associated with shipping, with which port sanitary authorities have special concern. Two of these may be mentioned, for example—*beri-beri* and *malaria*.

Expert inquiry as to beri-beri brings to notice preventable conditions caused by improper dietary of the sailor. Malaria inquiries direct attention to preventable conditions of exposure to dangerous malaria infection—for example, in West African ports. In addition, humanity and the interests of the sailor require that cases of such disease, although not infectious in the ordinary sense, should receive hospital treatment at our ports.

The legislative machinery for the prevention of the introduction of cholera, yellow fever, and plague into this country is comprised in an Order of the Local Government Board—"Regulations as to Cholera, Yellow Fever, and Plague; Ships arriving from Foreign Ports"—dated September 9th, 1907. These regulations comply with the terms agreed upon at the International Sanitary Convention of Paris, 1903. Certain modifications in the terms of the 1903 Convention were made by the International Sanitary Convention of Paris, 1912, but, owing mainly to the war, the ratification of the latter Convention was delayed and was only recently completed. A further revision of the International Sanitary Convention is now in progress.

So far as the mercantile marine is concerned, one of the most important duties imposed on port sanitary authorities is that of dealing with conditions adversely affecting the health of crews and with the insanitary condition of ships.

The question often arises whether the port sanitary authority should exercise its powers as to nuisances on board ship where structural alterations would be required for the abatement of the nuisance, or whether they should leave the matter to be dealt with by the surveyor appointed by the Board of Trade. Clearly the powers of the surveyors are concurrent with those of the port sanitary authority; there are many cases where a nuisance on shipboard requires abatement which do not come within the provisions of the Merchant Shipping Acts. The port sanitary authorities are in no way responsible, nor

indeed is the Ministry of Health, for securing adequate facilities for the medical or surgical treatment on shipboard of sick persons.

When dealing with the local sanitation of harbours, waterways, docks, and other shore premises within their jurisdiction, port sanitary authorities are hampered by lack of adequate powers to deal with accumulations of refuse, scavenging, and like matters. From the public health point of view there would be advantage in investing these authorities with wider powers than they now possess in regard to such matters.

The examination of imported foodstuffs, which is of very great importance, is regulated by Orders made under the Public Health (Regulations as to Food) Act, 1907, and has effected improvement in the national food supplies by preventing the importation of undesirable and unwholesome food.

Other special duties of port sanitary authorities are the protection of shellfish from sewage pollution and the sale of shellfish for food from beds and layings that are known to be polluted. The fall in the enteric fever attack rate in this country can be attributed in part to the prevention of specifically infected shellfish reaching our markets, etc.

If the various duties performed by port sanitary authorities are considered seriatim it will be seen that except in regard to inspection of food the duties are in part national and in part local; and this is represented in the financial arrangements made for the performance of the duties.

In 1920, the Government agreed to a grant-in-aid being made to port sanitary authorities of 50 per cent. of their approved net expenditure. This grant is subject to regulations prepared by the Ministry of Health with the approval of the Treasury, and the Ministry can withhold or reduce the grant in cases where a minimum degree of efficiency is not attained. The cost of a serious cholera, plague, or typhus epidemic, whether at one of the ports or inland, might easily be far greater than any expense to which the country or the shipping industry is put by reason of an efficient port sanitary administration. This point is so self-evident that it need not be laboured.

Desired progress in regard to infectious diseases could not be obtained without conferring on port sanitary authorities and their officers some additional powers and duties. Draft regulations were drawn up and submitted to the principal port sanitary authorities, and a deputation was received at the Ministry of Health at which the object and scope of the regulations were discussed and agreed to. As a result of most careful consideration the Port Sanitary Authorities (Infectious Diseases) Regulations were issued in 1920, and additional duties as well as powers were imposed on port medical officers of health. Probably the most important matter dealt with in these recent regulations is the danger of the spread of infectious diseases by vermin, especially the deratization of ships, which is one of the most urgent problems that concern port sanitary authorities.

In this country the fumigation of vessels for the purpose of destroying rats is usually carried out with sulphur dioxide gas generated by burning ordinary sulphur in pots, or sulphur candles, under suitable precautions against fire. This is an efficient fumigant when properly employed, and gives good results in so far as the destruction of rats is concerned, but it damages machinery and spoils paintwork, and for this reason a passenger vessel has often to be redecorated after undergoing sulphur dioxide fumigation. A number of vessels have recently been fumigated at British ports with hydrocyanic acid gas, which, unlike sulphur, has no harmful effect on machinery or paintwork, but, needless to say, this method of fumigation has to be used with the very greatest care owing to the danger to human life involved in the process.

It is understood that at Rotterdam and other ports in Holland trial is being made to fumigate vessels by means of a liquid known as "cyclon," which is composed of methyl cyano-formate 90 per cent. and methyl chloro-formate 10 per cent. The liquid volatilizes rapidly when sprayed into the air, the methyl cyano-formate giving off hydrocyanic acid gas and the methyl chloro-formate a gas which is intensely irritating to the eyes and respiratory surfaces, and this serves to give warning of its presence before the hydrocyanic acid gas reaches dangerous proportions in the atmosphere. The cyclon is distributed through the space to be fumigated by means of specially constructed brass "watering" cans, each fitted with a fine rose. This method appears to possess advantages over the ordinary methods of hydrocyanic acid gas fumigation, but as yet it is only in the experimental stage.

As a general rule before the war the port medical officer of health acted as the medical inspector of aliens on behalf of the Home Office, by whom he was remunerated for his services. The only aliens medically examined were steerage passengers, and then only those entering the country on ships carrying twenty or more such passengers were liable to medical examination. No definite instructions were issued to the medical inspectors of aliens as to the medical standard to be adopted. During the war the medical inspection of aliens fell into abeyance.

After the armistice the conditions under which aliens should be permitted to enter this country were the subject of consideration by the Aliens and Nationality Committee, which met under the auspices of the Home Office. As a result of this Committee's deliberations, the Aliens Order of 1919 was issued and came into operation on September 1st, 1919. Later, when the Aliens Restriction (Amendment) Act, 1919, was passed, this Order was superseded by the Aliens Order of 1920, which came into operation on April 1st, 1920. Under these Orders the Home Office is responsible for the exclusion of any alien from this country, and all aliens, whether first-class passengers or otherwise, are liable to exclusion on medical grounds or for other reasons which are essentially Home Office affairs.

All aliens are now liable to medical inspection at one or other of the thirteen ports scheduled in England and Wales for the landing of aliens, and the Minister of Health, with the concurrence of the Secretary of State, is empowered to appoint "medical inspectors" at each scheduled port and to issue instructions to them.

The port sanitary authorities concerned agreed to their medical officers of health acting as medical inspectors of aliens, and a scheme was devised and put into operation. During the two years that the scheme has been working it has been subject to local inspection by medical officers of the Ministry, and conferences have been held with the local medical officers and with the officers of the Home Office, who are responsible for the aliens' work of that department. The result of the experience gained is now under consideration with a view to determining whether any amendments are desirable.

Considerations arising from the Foregoing.

In reviewing our port sanitary administration from the points of view of the prevention of the introduction of disease into the country and the effect of this administration on our commerce, it will be realized that restrictive measures on the movements of ships, persons, and cargoes that are regularly and satisfactorily carried out and are well known to shipping companies and the travelling public to be in operation, are less prejudicial to commerce and to international relationships than the disturbance to trade and commerce that follows an outbreak of pestilence.

The history of the world shows that when a disease which is capable of developing epidemic proportions and proves rapidly fatal to a large proportion of those attacked by it has been absent for several years, there is a tendency for the precautions against its introduction to become relaxed or to fall into desuetude. On the other hand, when such a disease suddenly reappears in pandemic form after an almost complete absence for a long period of time, countries, provinces, or cities take steps to prevent its introduction into their midst that are in excess of actual requirements. It is necessary to avoid laxity on the one hand and scare and panic on the other.

No measures short of absolute national seclusion can be relied on to prevent the introduction of pestilence, and this seclusion would cut off the country from its means of existence. It is not suggested that the system of medical inspection now in operation is "water-tight" and that no leakage can take place; it is realized that under certain conditions a chance case of disease may find its way inland and that in such instances we have to rely on our inland sanitary administration to prevent diffusion of infection. Nevertheless grave responsibility to the public rests on port sanitary authorities to maintain a high standard of efficiency in their administration.

It is not the known but the unknown that we are afraid of. Once we are satisfied that we are fully apprised of the health conditions of an incoming ship the necessary steps can be taken to deal with the vessel. The object of the inquiries made of

the master on the arrival of his vessel by officers of customs and officers of the port sanitary authority is to obtain knowledge of the sanitary condition of the vessel and of the happenings during the voyage, in order that reasonable and efficient steps may be taken to prevent spread of disease. The officers of customs, when putting the health questions to masters of incoming vessels, do not board the vessel. If the replies are satisfactory they board for excise purposes. In the event of the replies proving unsatisfactory, the customs officers, however, have the power to detain a vessel for visit by the port medical officer of health.

These arrangements have worked well in the past, but it is necessary from time to time to consider whether they can be improved, and if so, in what direction. At present a large proportion of merchant vessels are fitted with wireless apparatus, and therefore in the future it may be found feasible for information as regards health conditions of an incoming vessel to be transmitted by wireless from the vessel to the port for which she is bound or to some centre whence the information can be forwarded to the home ports. It would then be possible to give the master instructions as to taking his vessel to the official mooring station or to direct him to bring his vessel straight into dock. Further, the master could be advised as to the steps he should take to deal with the health conditions affecting his ship, and such advice would be particularly valuable when a surgeon is not carried on a vessel. The port sanitary authority, warned beforehand, would be in a position to take the requisite action to deal with the vessel immediately on her arrival.

During the last quarter of a century considerable improvement has taken place in the general sanitation of vessels, but much still remains to be done in this direction. Experience shows that many of the existing defects are the result of insufficient consideration and lack of expert advice. In many cases it would cost no more to construct the crew's quarters on sound hygienic lines than on the faulty lines which at present are too often met with. This condition of affairs would be rectified were the plans of all new vessels submitted for consideration by an expert in marine hygiene.

It has to be borne in mind that for the success of our port sanitary administration we rely to a great extent on the integrity and probity of the officers of the mercantile marine, and for this reason, if for no other, they are entitled to sympathetic consideration and to all possible assistance in carrying out the duties imposed on them for the protection of the public health.

DISCUSSION.

Dr. W. F. DEARDEN (M.O.H. Port of Manchester) thanked Dr. Reece personally, and on behalf of port medical officers generally, for his excellent summary of port sanitary administration. Too little was known by the general public of this "first line of defence," and his paper would help to remedy the defect. Early measures were too severe and restrictive, they hampered trade—hence their failure. The new regulations of 1920 had much improved the powers of port medical officers to control the importation of infectious disease, but there were still a few loopholes which required filling up. As examples of these he quoted the difficulty of ascertaining accurately the destination of contacts from an infected vessel, the responsibility of the ship's master to report cases of infectious disease which he was unable to diagnose, and the lack of facilities for isolation of cases on board ship. The port medical officer should be able to deal with insufficient and insanitary latrines provided for the use of seamen on the quays.

Dr. W. W. KING (U.S. Public Health Service) spoke on behalf of the Surgeon-General of the United States Public Health Service, Dr. H. S. Cumming, who was unable to accept the invitation to be present. In Dr. Reece's address he had found many parallels in the duties, powers, and limitations of the port health officer. Quarantine he likened to a sieve intended to pass the harmless and stop the harmful. It was imperfect, and there was a constant endeavour to strengthen it without interfering with travel and commerce. When the fear of an epidemic occurred there was an opportunity for improvements in the service, and such was the case in America in 1893 during the prevalence of cholera in European ports. It was then that men were first stationed at American consulates abroad to deal with the sanitation of vessels, passengers, and crews destined for United States ports. Such health officers occupied the important position of outposts in the first line of defence.

Major R. W. H. JACKSON (R.A.M.C., ret.) gave his personal experiences as a former Army Health Officer both at home and abroad. As special health officer in Calcutta in 1903 he could testify to the difficulties of diagnosing plague. He had had experience of cholera and small-pox in Karachi, yellow fever in the West Indies, typhus in Ireland, and leprosy in the East and West Indies. He had found that severe penalties for concealment of disease on board ship defeated their object. Enforcement of cleanly habits and a supply of wholesome water were the two great difficulties encountered in dealing with merchant vessels in foreign and tropical ports. He thought wireless telegraphy would be a useful adjunct in notifying sickness on board.

Dr. J. C. MCVAIL expressed the opinion that to prevent interference with trade the ideal was to have the country made as far as possible sanitarily invulnerable to invasion. A main difference between the American and British systems was that the former took protective and preventive action at the ports of departure of immigrants, even though the amount of emigration from all parts of the world was very much greater to America than to Britain. In Scotland the only joint port authority was that of the Clyde. Each port on the Forth was independent, and therefore responsible in its own area only.

Dr. HERBERT JONES referred to the excellence of the work carried out by the port sanitary medical service as the reason why it might not be well known. He was of opinion that the transmission to inland medical officers of health of notices giving the addresses of contacts on infected vessels was of very great use, and he hoped there would be no question of discontinuing the practice.

Dr. REECE, in reply, stated that it was unfortunate that only emigrant ships were obliged to provide hospital accommodation. Contact on board a ship at sea was very intimate, but attempts were being made in the newer vessels to disperse the sleeping quarters of the crew. The tracing of persons from infected ships was admittedly a difficult matter, and he could see no satisfactory solution of the difficulty. Much depended upon the probity of the master, and he deserved consideration for the many responsibilities which he undertook.

THE ECONOMICS OF PUBLIC HEALTH.

BY

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THE need of economy after the war, both in national and private life, is so obvious that there is a danger of expenditure being reduced without regard to the return expected of it unless that return can be shown in pounds, shillings, and pence. This is especially the case in measures that aim at the promotion of mental and moral values, for whereas currency is but the financial language of material value, and economy in public affairs deals with material currency alone, mental and moral values have yet no counterpart in monetary language. In the promotion, therefore, of the public health the many intellectual and moral advantages that result from health cannot be represented in financial terms, and there is a danger, both in national and local government, of necessary services being curtailed as if the moral values were a matter of no importance. In certain other fields—as in education and in religious matters, for instance—this is even more serious than in public health, for in those spheres no material profit can be definitely shown as a result of suggested expenditure. But in public health we have this advantage, that there are definite material gains from wise expenditure which can be shown to be reduced by a reduction of that expenditure. This paper sets out to show—or rather to suggest as a basis for further study—the material loss occasioned by physical sickness and disablement and the material advantages that may be obtained, or have been obtained, from improvements in the public health. We

recognize definitely that this is only part—perhaps only a small part—of the advantages obtained and obtainable. But with regard to these material advantages much slipshod language is commonly used in support of the measures taken or proposed. The advantages claimed are usually set forth only in general terms, which do not appeal to the business man or to those responsible for public finances, and the cynic, who plays a most useful part in these hard times, has an overwhelming advantage unless the case for the material advantages of the public health services can be set out in the common language of finance.

In reconstruction of our public and industrial life the object must be to provide efficiency and a maximum and optimum output with the least present expenditure and without any sapping of individual effort. In this Section we are concerned with the improvement of health as a whole, resulting from improved social conditions and material prosperity—especially of the wage-earning classes, but by no means confined to them—through many agencies, guided, instructed, inspired, often directed and even directly promoted by the machinery of national and local government, mainly through the officials of their public health services, and more particularly by their medical officers of health. As the first appointment of a medical officer of health was that made by the city of Liverpool in 1847, and appointments only became general under the Public Health Acts of 1872 and 1875, the progress of the public health movement may be said to be concerned mainly with the past half-century. Farr's *Vital Statistics*, dealing generally with conditions before 1870, may be taken as our guide to conditions before the public health movement set in, and the figures of the middle of the last century may be contrasted with those of the present day.

With these qualifications we may embark on our inquiry under the following headings:

Present:

1. What do sickness and disablement cost by loss of patients' work?
2. What do sickness and disablement cost in care and treatment?
3. What does it cost to maintain public health services?

Past:

4. What has been gained by the reduced number of deaths in sixty years?
5. What has been gained by increased expectation of life in sixty years?

Future:

6. What saving could be effected, as a single definite instance, by the elimination of tuberculosis?

1. *What do Sickness and Disablement Cost by Loss of Patients' Work?*

Let us consider the following figures:

Male members of approved societies in England and Wales = 8,637,095 (2nd Annual Report of Ministry of Health, 1920-21, pp. 153, 163).

Expenditure upon sickness and disablement benefit among men = £4,771,702 (Annual Report of the Chief M.O. of the Ministry of Health for 1920, p. 19); this represents an average minimum of incapacitation for 8,916,059 weeks, which is equal to the loss of a year's work of 178,280 men, or 2 per cent. of the insured male population.

Now the insured men number nearly one-fourth of the population, and there is further loss for which benefit would not be claimed. Therefore the total sickness and disablement of the whole population corresponds to a permanently sick or disabled population of, say, five times 178,280 = 891,400.

A somewhat similar result may be obtained in another way. Farr concluded that the total number of sick at any time throughout the year was about double the number of deaths occurring during the year. The number of deaths in England and Wales in 1920 was 466,213, and the number of sick and disabled would therefore be 932,426.

These two estimates approximate to one another, and suggest that 2½ per cent. of the population are on an average incapacitated by sickness and disablement. Production would thus be reduced by sickness and disablement to the extent of 2½ per cent.

(*a*) What does this signify to the Exchequer? The Exchequer receipts from personal services and production, excluding the return from capital, may be put on a conservative estimate at £100,000,000, and the loss to the Exchequer, therefore, from the incapacity of those sick and disabled equals 2½ per cent. of this figure, or £2,500,000 per annum.

(*b*) What is the loss from sickness and disablement to the national income? Estimates of the national income vary between three and four thousand million pounds. Accepting the lower figure, and taking one-third of it as representing the yield of capital, we arrive at the national income from personal services as £2,000,000,000 per annum, and the loss to the national income, therefore, from the incapacity of those sick and disabled is 2½ per cent. of this figure, or £50,000,000 per annum. To this should be added, if we could estimate it, a very large loss from minor incapacity and from the lowering of health and moral from minor or temporary or incipient conditions of sickness and disablement.

2. *What do Sickness and Disablement Cost in Care and Treatment?*

The number of sick and disabled has been reckoned above as 932,426; of these the number in certain institutions is given in the census of 1911 as 434,843; the others are mainly being treated at home, and will number 497,583.

(*a*) *In Institutions.*—The number of patients and staff in workhouses, asylums, and hospitals (census 1911) = 506,723; of this number the staff = 71,880 and patients = 434,843. The cost of maintenance of the above institutions, at an average of £100 a year per head, would be roughly £50,000,000.

(*b*) *At Home.*—The number incapacitated, as estimated above = 497,583.

Number of doctors, subordinate medical service and nurses, by census	123,400
Number of chemists and druggists	60,851
Number of surgical instrument makers	9,155
Total	193,406
Deduct staff in institutions	71,880
Number professionally engaged in attending on home sick	121,526

To that figure of 121,526 should be added the number of attendants and those engaged in ancillary occupations (other than doctors, nurses, etc., shown above), and we may therefore estimate that the number concerned with the care of the home sick is as high as 200,000.

Cost of these (at £120 per annum)	= £24,000,000
Add maintenance of home sick (at £70 per annum)	= £35,000,000
(*a*) and (*b*) *Total* (£50,000,000 *plus* £24,000,000 *plus* £35,000,000)	= £109,000,000

But to this figure must be added the indirect effect of epidemics on industry, which at a low estimate we may place at £11,000,000, thus bringing the total material cost in care and treatment to £120,000,000. From this, however, should be deducted the cost of living of non-adults below 20, which is taken roughly as the beginning of the productive period of life, as such cost would in the main be a charge on the community also in health. If cost of living account for one-half of the cost of maintenance, one-third of which is in respect of persons under 20 years of age, then this deduction amounts to one-sixth of £120,000,000, or £20,000,000. The net cost, then, of care of treatment of the sick and disabled may be estimated at £100,000,000.

1 and 2. *Total Loss from Sickness and Disability.*—Add to this the loss to the national income from the incapacity of sick and disabled, already reckoned at £50,000,000. The total direct material loss to the community in England and Wales from sickness and disability is then £150,000,000.

This is of necessity but a rough estimate, but it is a minimum. Certain omissions, definite but difficult of estimation, have already been noted. Another very large omission is that of work lost to the community by the 71,880 staff of institutions and by the 200,000 persons engaged in professional and occupational attendance on sickness at home who would otherwise be free for productive work. The cost of maintenance and the loss of productivity of relations and friends attending on the sick have also been omitted. Such charges would not for some years be set free in case sickness and disablement could be eliminated from the community. But they figure largely among the expenses of the Sick Account.

3. *What does it Cost to Maintain the Public Health Services (Water, Drainage, Sanitation, and the Like)?*

This is a matter which we can hardly bring into our public health budget; but the following figures, taken from the second Annual Report of the Ministry of Health (p. 204), are suggestive:

Expenditure of Local Authorities in England and Wales (other than out of loans).

	£	£
Public health:		
Sewers and sewage disposal	6,183,101	
Collection and disposal of house refuse	4,588,666	
Hospitals, sanatoriums, dispensaries, etc.—		
For tuberculosis	1,310,698	
For venereal diseases	218,251	
For other diseases	2,241,668	
Maternity and child welfare	687,180	
Baths, washhouses, etc.	1,122,134	
Parks and open spaces	1,728,616	
Vaccination	120,578	18,191,892
Lunatics and lunatic asylums		5,476,637
Mental deficiency		183,995
Housing of the working classes		1,072,488
Relief of the poor (excluding maintenance of lunatics in county and borough asylums)		14,863,024
Cemeteries		997,506
Waterworks		11,291,242
		£52,076,784

It is impossible to say what proportion of these services is debitable to public health, still less what proportion could be diminished if preventable diseases were prevented and, so far as possible, exterminated. Moreover, the expenditure on these matters from the public purse is inextricably mixed with expenditure from private sources—as, for instance, house construction and drainage, or in improvement of the food supplies. But it is this expenditure which must be set on the debit side of the account to be contrasted with the material value of the improved public health on the credit side.

4. *What has been Gained by Reduced Number of Deaths in Sixty Years?*

Let us for the sake of suggestion give the following figures taken from Sir George Newman's *Outline of the Practice of Preventive Medicine*, an official memorandum addressed to the Minister of Health and published in 1919 for 6d., and from the Registrar-General's quarterly return No. 292 dated January 31st, 1922.

	England and Wales.		London.	
	Death Rate.	Infant Mortality.	Death Rate.	Infant Mortality.
1851–60 ("the fifties") ...	22.2	154	23.7	155
1911–18 (60 years later) ...	14.8	105	15.5	106
1921	12.1	83	12.4	80

Compare (1921):	Death Rate.	Infant Mortality.
Bombay	54.7	?
Madras	33.8	281
Vienna	15.3	146
Paris	14.8	95
Berlin	12.4	135
New York	11.2	71
Amsterdam	10.3	54

Comparing, then, the deaths at the earlier period with those sixty years later (for these purposes the mortality in England and Wales 1847–50 is compared with that of 1901–10) the mortality rate in the first period applied to the population of the second period would have given 887,083 deaths; but the actual recorded deaths averaged in a year 575,515; therefore the number of lives saved yearly was 311,568. Of this number over one-third (namely, 119,377) lives were saved owing to the decline in mortality from small-pox, typhus, enteric fever, cholera, and diarrhoeal diseases—a reduction mainly due to sanitation.

Now these lives have a definite value, and I would ask the political economists to give me a good estimate for such value. The best figures I have been able to find are those provided by Sir J. Kay-Shuttleworth's "Return of wages of the best class of labourers in Norfolk,"* presumably in the middle of the last century, quoted under the heading "Value of a man's services" in Farr's *Vital Statistics*, p. 534.

At the age of 25, comparing professional men on moderate incomes with agricultural labourers, the following figures are given as the value lost by an individual death:

	Professions on Moderate Incomes.	Agricultural Labourers.	
		High Scale.	Low Scale.
Future earnings	£ 10,462	£ 1,068	£ 795
Present value of future earnings at 3 per cent.	5,329	627	481

Kay-Shuttleworth calculated that at the age of 20, on a 5 per cent. basis, the prospective value of an agricultural labourer in Norfolk was £482; but from that figure should be deducted the amount required for necessary maintenance (£248)—giving the net value of his future services to the community as £234. Supposing, then, we say that the labourer of Norfolk dying at the age of 20 (at the far lower value of his services sixty years ago than that of the present time) is over the average figure of present-day value for all lives lost, and taking such average to be £200, then the reduction of the last sixty years (311,568 deaths every year) is equal to a saving of £62,313,600 per annum.

Again I say that this is only a rough estimate of the value of the lives that have actually been saved. I hope political economists will compute this figure correctly. But that the lives saved have a value approaching the enormous figure given above, and that this saving is a result of the improved conditions of life and attention to health, is a fact.

5. *What has been Gained by Increased Expectation of Life?*

Another way of estimating the effect in improvement of health has been by calculating from life tables the increased expectancy of life. Comparing the life tables compiled respectively by Farr for the years 1838–44 and by King for the years 1910–12 (giving a contrast of seventy years), we find that

The mean after-lifetime of males aged 20 in 1838–44 was 40.0

and that

The mean after-lifetime of males aged 20 in 1910–12 was 44.2

Therefore the age of productive labour was increased in seventy years by over 10 per cent. As we have already seen that the national income from personal services at a conservative estimate is reckoned at £2,000,000,000 a year, the saving by increased age of productive labour during these seventy years amounts to £200,000,000 a year.

Moreover, a larger proportion of children born reach the productive age. In the earlier period out of every million males born 653,357 attained the age of 20 years; but in the latter period out of every million males born 793,435 attained the age of 20 years, so that in the later stage for every million born 140,078 more reached the productive age, and the community expends so much less a head relatively on the unremunerative period of life.

6. *For the Future what Saving can be Effected, as a Single Definite Instance, by the Elimination of Tuberculosis?*

Tuberculosis is one definite cause of sickness which gives us definite figures on which to base a financial inquiry. Whether the total extinction of tuberculosis mortality is within the realms of possibility is immaterial to this calculation; but it may be observed that the average tuberculosis mortality for the years 1881 to 1885 was twice as heavy as that of 1919. The extinction of tuberculosis would thus, at the present time, mean no more than a reduction equivalent to that which has already taken place. Moreover, the 1920 mortality rate from tuberculosis was over 10 per cent. below the 1919 mortality from the same cause, and may be considered as a 10 per cent. instalment of total extinction. Had, then, the 1919 death rate been reduced by an extent equivalent to the 1919 mortality from tuberculosis, it is shown in life table form that within the productive ages 16 to 65 the

* His life has recently been written by Mr. Frank Smith, Lecturer in Education, University of Aberystwyth, with an introduction by Sir Michael Sadler, K.C.S.I., and a chapter of reminiscences by Lord Shuttleworth (published by Murray). Sir James Kay-Shuttleworth (1804–1877) was the first Secretary of the Education Department and laid the foundations of a national system of education. His early life brought him into close contact with the social problems of his day; for, first as a physician in Manchester and then as an Assistant Poor Law Commissioner in East Anglia and London, he gained an intimate knowledge of the urban and rural conditions which followed the industrial revolution. Thus equipped in medical science, practical philanthropy, and wide experience, he accomplished great administrative work as a courageous pioneer in office and as a public man in Lancashire, notably during the cotton famine.

years of life actually lived would have been increased by 4.7 per cent. Production in the year in question could therefore have been increased 4.7 per cent.; the increase in the Exchequer receipts from taxation (on the most conservative estimate of £100,000,000) would, it might fairly be assumed, have been increased by £4,700,000, and the national income of £2,000,000,000 from personal services by £94,000,000.

But, furthermore, tubercle affects more especially the productive ages of life. Assuming that production is limited to the ages 16 to 65 and that all other ages are dependent, the elimination of the 1919 mortality from tuberculosis would increase the productive years of life by 0.48 per cent. more than it would increase the unproductive years. For with the 1919 mortality from all causes there were by the life tables €4.47 years of productive life to maintain a hundred years of life; and in case of the extinction of tubercle there would be 64.78 productive years of life to maintain a hundred years of life. The difference is 0.31 year of life, which is a percentage increase of 0.48. The following argument is then suggested to me from a distinguished quarter. Taking the conservative figure of £2,C00,000,000 as the national income from personal services, excluding return from capital, it is suggested that the extinction of tuberculosis would add a further sum of £9,600,000 annually to the national income. Capitalized at 5 per cent., assuming that the above percentage surplus of 0.48 accumulated as capital, this would be worth £192,000,000. I pass on this suggestion for what it is worth and invite correction.

The subject has been worked out very thoroughly in the United States of America, and it is there estimated that at the age of 20 tuberculosis reduces the expectation of life for the whole population of the registration States by 2.4 years. Economists calculate that for the whole population of the United States each year of life expectancy lost is equal on the average to a net loss of £20 to the national wealth. On account of tuberculosis, therefore, each person is worth approximately £50 less to the national wealth, and the State loss is (on 1911–16 population of 106 millions) £5,300,000,000, or (as average lifetime in the United States is fifty years) £100,000,C00 per annum from tuberculosis alone.

Conclusion.

It will be seen, then, that the ascertainable cost of sickness and disablement to the community in England and Wales amounts to no less than £150,000,000 per annum. To this should be added large sums which I have been unable to express in financial terms. Judging from the estimate of £94,000,000 a year as the loss from tubercle alone, the estimated loss of £150,C00,C00 from all forms of sickness would seem to be grossly underestimated.

It will be seen that the public health services cost many millions a year. It will also be seen that during the course of the public health movement in the past sixty years the improvement in health has given a very large possible increase in output, which, reckoned on the basis of lives saved and the average wages of an agricultural labourer sixty years ago, works out at £62,000,000 a year; but reckoned from the increased expectation of life amounts to £200,000,000 a year—several times more than the amount spent on maintaining the public health services.

It is not claimed that all the loss to the community from sickness and disablement could ever be abolished, nor the services of public health be materially, if at all, diminished; but as in the past sixty years, so now, a large amount of sickness and disablement is still preventable.

In America, where this subject has been explored more thoroughly than in this country or, so far as I know, in any other, it is estimated that sickness and death in the United States, with a population about three times as great as that of England and Wales, cost £600,000,000 per annum, of which at least one-third is regarded as preventable. The ratio of preventability is defined as "the fraction of all deaths which would be postponed if knowledge now existing in well-informed men in the medical profession were actually applied in a reasonable way and to a reasonable extent."

As an instance of what may reasonably be expected in the prevention of sickness in the near future, we have taken the possible elimination of tuberculosis and shown such elimination should add £4,700,000 yearly to the Exchequer and £94,000,000 yearly to the national income. It is obvious, therefore, that any effective measures that have yet been proposed for the reduction of tuberculosis would be financially justified if consideration be merely confined to the material profit and loss to the Exchequer.

Stress must, however, be laid on the epithet "effective." Many measures put forward in perfect good faith by experts and by the public are not yet sufficiently substantiated to merit their adoption as "effective." Many are advocated too much from the standpoint of those who seek to raise the material comfort of the workers out of the Exchequer. While improvement of feeding and of other social conditions may be expected to diminish tuberculosis and improve health, it might have a precisely contrary effect if the method adopted were to undermine initiative, moral, and personal care of the individual. It is imperative for medical officers of health and for the medical profession generally, as expert guardians of the public welfare, to stand between the public and the Government; to recommend to the latter only such measures as can be proved to have value, and, in putting forward suggestions and hypotheses to be most careful in stating the limiting conditions.

With these reminders I beg confidently to recommend a serious study of the subject (of which the present paper is only a preface) to the attention of this Section, of the whole medical profession, and of the nation at large.

Acknowledgement is due more especially to Dr. W. H. Hamer, Medical Officer of the London County Council, for notes which he furnished to me on the subject, and to others who have helped me with information.

Amongst the articles and papers used in the preparation of this paper are:

Vital Statistics, by Dr. W. Farr.

Public Health and Insurance, by Sir A. Newsholme, 1920.

"The Economics of Health," by Dr. James Niven (address to the Manchester and Salford Sanitary Association, April 25th, 1902).

"The Cost of Disease," by Dr. James Niven (being a paper read before the Manchester Statistical Society, March 8th, 1911).

The Economic Advisability of Inaugurating a National Department of Health, by J. Pease Norton, Ph.D. (Chicago Press of the American Medical Association, 1906); and

"Report on National Vitality, its Waste and Conservation," by Professor Irving Fisher, of Yale University. (Bulletin No 30 of the Committee of 100 on National Health. Washington: Government Printing Office, 1909.)

DISCUSSION.

Dr. MACFADYEN (M.O.H. Letchworth) said that this kind of research would be excellent, but should be worked out first for a large city like Glasgow. He admired the work of Dr. Chalmers in this city, but was convinced that, though excellent, it had gone beyond the point when it was economical—in other words, Glasgow was too big and should be divided up. The cost of public health from a national point of view could not be divorced from the cost of police and Poor Law.

Dr. HERBERT JONES disagreed absolutely with Dr. Macfadyen that too much was being spent on public health services. It would be found, if the amount were expressed in proportion to rateable value, that extraordinarily little was being spent, and in all probability the expenditure in the garden city of Letchworth, when so expressed, was as great as that in Glasgow when the difference in the municipal enterprises were considered. In rural districts the cost was rarely above an amount equal to a penny rate, and though in towns it might be much higher, even then, when so expressed, it was not alarming. Expenditure on public health measures, instead of being reduced, should be increased.

Dr. MILLER (C.M.O. Radnor) thought it desirable that proper units for public health administration should be formed with a population of about 50,000 and of suitable area. The burden of providing proper water supplies and efficient sewerage systems for small urban and rural areas would be eased and simplified by combination. Improvement in health and increased expectation of life should be accompanied by greater output of work per person.

Dr. A. K. CHALMERS (M.O.H. Glasgow) stated that so far as Glasgow was concerned the cost of public health works had risen from pence to shillings per head, but the death rate had been halved. Before comparing one place with another the kind and extent of the work done should be taken into consideration.

Dr. FREMANTLE, in reply, emphasized the fact that his paper was merely meant to introduce the subject and to encourage others to look at public health work from a standpoint which had not hitherto received much attention.

INTERPRETATION OF THE DEATH STATISTICS OF INFANCY AND CHILDHOOD IN RELATION TO DEVELOPMENT AND ENVIRONMENT.

BY

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THE result of environment upon child life is an exceedingly complex subject. I would like to-day to direct attention to some of the main conclusions which can be drawn from the statistical side and to point out the relations these may have to the problems of administration.

The chief branch of the subject I wish to discuss is one which has specially interested me—namely, the manner in which the death statistics throw light upon the physiological changes which take place in the developing child. From conception onwards the physiological processes in childhood have certain obvious divisions, but there are others which are not so easily observable. The first of these is ante-natal. The second is the short period of actual birth with some few succeeding days. These are definite and easily recognized. But with birth a number of other risks are present. With their sudden change of environment the respiratory, digestive, and nervous systems have new and special work thrown on them. These changes are associated with very special dangers, dangers which must be still greater when the birth is premature. There is thus a very high mortality in the first month of life which rapidly declines. There is, however, a third group of changes which are truly developmental. Thus we find during the first year of life periods at which digestive and lung diseases are specially frequent, while with some of the specific fevers the highest rate of mortality may occur as late as the fourth year. These points will be discussed in detail.

The first period of life is the parasitic period in the uterus. In this period, to my mind, heredity plays the main part, and there is very little statistical evidence that the environment in which the mother lives produces much immediate effect. Thus the infantile death rate in the rural counties in the first month of life, as given by the Registrar-General for England, is very little different from that in the urban counties, the figures being respectively 36.9 and 39.9 per thousand births—an increase of 8 per cent., while the increase of the urban over the rural infantile death rate under one year for all causes is 30 per cent (see Table I). The figures published by the medical officer of health for Brighton, Dr. D. Forbes, show that only when the best class of house is reached is any special difference found; below this level the death rate is practically constant. Some figures collected by Dr. Findlay and Miss Agnew relating to Glasgow (in process of publication) show the same thing. The environment, therefore, of the mother during pregnancy is not of such great importance to the immediate welfare of the child as might be supposed. I do not of course maintain that there is no advantage to the child afforded by ante-natal care of the mother. Ante-natal care will probably diminish abortion and will undoubtedly save the lives of a certain number of children. The amount of saving, however, cannot in any case be very large. There is, apparently, for every thousand children born about thirty stillbirths, and of these Dr. Holland estimates that with better midwifery and with ante-natal treatment a half may perhaps be saved.

TABLE I.—*Showing the Death Rates per 1,000 Living Births among Infants during the First Twelve Months of Life in the Urban and Rural Registration Counties from Infantile Diseases and Diseases due to Infection.*

	Infantile Diseases.		Diseases due to Infection.	
	Urban.	Rural.	Urban.	Rural.
Under 1 month ...	36.43	34.62	3.45	2.28
1–2 months	7.29	6.62	5.90	4.09
2–3 ,, ...	4.37	4.05	5.83	3.83
3–4 ,, ...	3.09	2.80	5.73	3.56
4–5 ,, ...	2.29	2.02	5.39	3.18
5–6 ,, ...	1.83	1.56	5.16	3.01
6–7 ,, ...	1.51	1.36	5.01	3.01
7–8 ,, ...	1.38	1.19	4.99	2.91
8–9 ,, ...	1.10	0.95	5.02	2.83
9–10 ,, ...	0.98	0.83	4.87	2.85
10–11 ,, ...	0.81	0.65	4.65	2.62
11–12 ,, ...	0.77	0.66	4.55	2.51

Infantile Diseases.—Premature birth; congenital defects; starvation; atrophy, debility, marasmus; injury at birth; convulsions; suffocation; other causes.

Diseases due to Infection.—Measles; scarlet fever; diphtheria; whooping-cough; enteritis; gastro-enteritis; gastro-intestinal catarrh; diarrhoea; tuberculous meningitis; tuberculous peritonitis; other tuberculous diseases; syphilis; erysipelas; rickets; meningitis; laryngitis; bronchitis; pneumonia; gastritis; gastric catarrh.

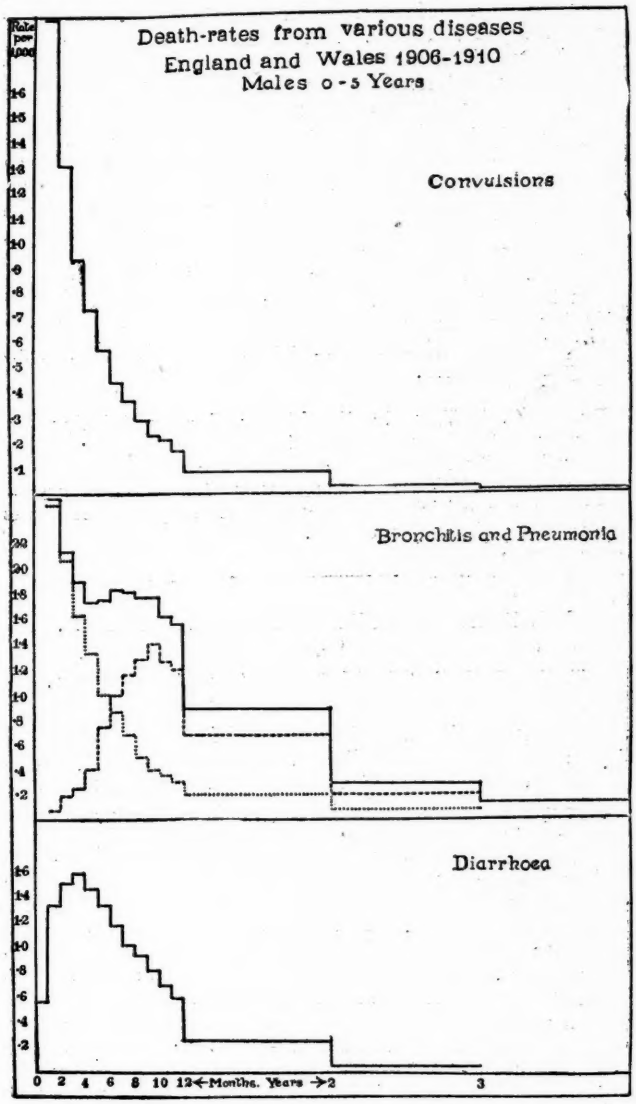
What is important to the child is its own environment after birth, and if that of the mother be bad the child's will be equally so. If the environment is good the recuperative force in a child born of parents of good stock is such that even when during the late months of pregnancy the nutrition of the child is bad, this is very generally rapidly restored after birth. The influence of the health of the mother upon the health of the child after birth, however, stands in a different category. The child is dependent for its growth upon healthy food, and an unhealthy mother is in most cases quite unable to produce milk in amount and quality required for the child's upbringing, with the result that artificial feeding must be adopted, and with artificial feeding the chances of alimentary disturbances are considerably increased. It is in this direction that it would seem that ante-natal care of the mother will be of the greatest importance.

Passing now to the act of birth, the child as it is being born is seen to be subjected to intense strains—strains in many cases sufficient to produce death, and in many other cases disturbances such as are not recovered from for some weeks or months; but these conditions, the result of trauma, do not concern us here. What does concern us is the change of environment which takes place as regards the child. The system which is first involved is the respiratory, the method for the provision of oxygen for the physiological processes being suddenly and almost in an instant changed. The change alone is sufficient in a number of cases to produce death, the heart of the child acting at birth, but respiration never becoming established, though this is commonly associated with cerebral injury.

In association with this there is the change in nutrition, the infant having to digest its own food. In many cases the response to the stimulus of food fails and the child dies of atrophy or inanition.

Much more interesting, however, are the changes which take place after birth. These changes may perhaps be best understood first by taking two typical examples. The first type, which may be called the true infantile mortality, decreases very rapidly after birth. Of this the best example is the course of the death rates ascribed to convulsions without predisposing cause. The death rates are illustrated in the diagram, in which the first entry refers to the second month of life, the death rate from convulsions in the first month being so great that it cannot be inserted. The progress of the fall in the death rate is perfectly regular. It is not only possible to graduate the death rates at each month under one year to a suitable mathematical curve, but when the curve has been fitted to these values of the death rates it is possible to predict the number of deaths in the next three years of life with very great accuracy. It can therefore be taken that the gain in stability of the nervous system with growth in the average child is regular and governed by very definite laws. These laws are fundamentally powerful, for it may be observed that there is no evidence that the period at which teething commences affects the number of deaths. What causes convulsions is of course not known. It must be related to an instability in the nervous system on which many different disturbances of health produce the same result. The whole environmental risks of the child, therefore, must be taken as acting on a nervous complex, but the factor which determines the likelihood of death at each age is to be found in the condition of the nervous system as it passes from instability to stability. It is further to be noted that the occurrence of convulsions is to a very great extent independent of hygienic environment, the children in the rural districts having an almost identical death rate at

each age from convulsions with that of the urban districts; the death rate under one year in the urban districts being 11.19, and in the rural districts 11.04. The above remarks are confined to deaths from convulsions when this is given as the chief cause of death. Deaths from convulsions in the ordinary summer diarrhoea or the ordinary pneumonia of childhood—causes given as the primary cause of death—appear under the heading of the primary cause and not under the heading of convulsions. Were this not the case, it is hardly probable that the progress from age to age would be so regular.



As convulsions may be taken as the type of one physiological change, so diarrhoeal diseases may be taken as a second type. The course of the death rate from diarrhoea is illustrated in the diagram. Here we find that ordinary diarrhoeal diseases are not common in the first month of life, but after the first month death becomes more and more common until the fourth month is reached, after which the decline in the death rate is slower and slower. In this case it is again possible to take the death rates under one year of life, fit them to a mathematical expression, and predict the death rate for the next two years of life. Here again we must have some cause determining the rate of change, a change shown by the different response of the child to this type of infection. It may be regarded in the light that in the growing child during the development of the digestive system some substance or condition of the alimentary tract which tends to instability is produced, and that the causes which lead to this instability are in their turn removed so that the digestive system resumes its stable condition. Another common abdominal disease of childhood, tuberculous peritonitis, also shows a similar course in the death rate. In tuberculous peritonitis, however, the maximum death rate is about a fortnight to three weeks later than in the case of diarrhoea, as is to be expected on account of the more chronic nature of the disease.

The changes which take place in the lungs, as shown by the presence of respiratory disease, fall next to be discussed. The two chief diseases are bronchitis and pneumonia, and in the young child there is a great clinical difficulty in differentiating them. At the present moment the pathology of this subject is in a very unsatisfactory state. Even when by clinical observation the diagnosis seems to be quite clearly bronchitis, microscopical examination may record more or less extensive alveolar infection. The course of the death rate from the combined respiratory diseases is shown in the diagram. There is a fall during the first few months of life, followed by a rise. Here a level is kept for a considerable time, to the end of the first year, and (if the statistics were available) probably for a few months into the second year. A marked hump like this on the curve of the death rate seems always to be due to a mixture of diseases. In the separate certifications bronchitis appears much more in the earlier months of the first year, pneumonia in the later months. I do not think, however, the certificates of death differentiate to the extent that might be possible. What has been done, therefore, is to take the death rates as they stand and make a rough analysis into two types of diseases, one of which—bronchitis—is a true infantile disease, the death rate from which decreases steadily from birth, and the second a disease in which the death rate rises to a maximum about the ninth or tenth month of life and thereafter declines. During development in the first two months of life elements causing instability predisposing to bronchitis pass away, possibly simply by the growth in the size of the tubes of the respiratory apparatus permitting mechanical cleansing more readily, but also possibly associated with the increasing local immunity of the mucous membrane enabling it to withstand infection. On the other hand, pneumonia, from being a less common cause of certification of death in the early months, rises to a maximum in the eighth and ninth months and thereafter declines. In the growth of the lung, therefore, there is a period during which a temporary instability appears, much the same as in the digestive system there is a period followed by the growth of a greater and greater power of resistance. On this interpretation an analysis of the combined cases of respiratory disease shown in the diagram has been made. Bronchitis is shown by a dotted line and pneumonia by a line of dashes, the sum making the combined graph of bronchitis and pneumonia and showing how the large hump on the graph in the latter months of the first year is to be explained. As regards the infective agent, it is natural at first to think that one class of organism will produce bronchitis and another pneumonia, but this is not necessary. If there be two kinds of instability—an instability which gradually disappears and an instability that develops—it is, I think, quite possible that the same cause might produce both bronchitis and pneumonia and also account for the fact that it is very difficult to differentiate the two diseases. But that there are two diseases, in the sense of two responses to irritation, I have no doubt. This is made certain when the death rate from pneumonia, as given by the analysis, is compared with that of measles. If the curves of these death rates are placed above one another they are almost identical. During the early months of life death from measles is exceedingly uncommon, but it begins to be more common at the fifth month, has its maximum about the twelfth month, and remains high during the first year of life, thereafter decreasing very markedly. Now deaths from measles in young children are nearly always associated with that suffocative catarrh which occurs when the rash appears in the lungs, and which in many cases, if the children do not die at that stage, passes into bronchopneumonia.

All the other diseases of infancy come into one or other of these two classes with the exception of some of the specific fevers. With these diseases there is a quite definite increase of susceptibility with age, the maximum susceptibility to scarlet fever occurring apparently between the ages of 5 and 6 years; to diphtheria between the ages of 4 and 5 years; and to whooping-cough between the ages of 2 and 4 years. It is to be noted, however, that in all these diseases the mortality steadily declines though the susceptibility increases.

The importance of the phenomena just shown lies in the light they throw on some questions of immunity. It is commonly stated that children continually receive small infections of different kinds and thus develop immunity. In this manner

the age variation of susceptibility to disease is explained. In one case, fortunately, the case of summer diarrhoea, this can be completely eliminated. The incidence of the disease is here practically confined to two months in the summer, so that children of all ages under one year of age are exposed for the first time to infection during a narrow interval. The course of the death rate, therefore, must be associated with something else than the child's acquired immunity, and it seems practically certain that the susceptibility to death is due to some physiological condition in the individual. Another explanation offered to account for the smaller number of deaths from diarrhoea under the age of four months is that more children are being fed on the breast at the earlier ages; this also seems to me to be difficult to accept, since the progress of the susceptibility to death from age to age can be so uniformly graduated, the graduation describing not only the death rate under one year but permitting prediction of the death rate for the two following years of life. Taking, again, the deaths from convulsions, where the death rate follows just as rigid a course—that the cause must be sought in the physiological development of the child is strongly suggested.

TABLE II.—*Mean Infantile Mortality in Groups of Registration Districts, with the Actual Mortality between 2 and 3 Years of Age and a Calculated Mortality, if the Mortality at the latter Age Rose Correspondingly to the Infantile Mortality.*

MALES.			FEMALES.		
	Mortality 2 to 3 Years.			Mortality 2 to 3 Years.	
Mean Infantile Mortality.	Actual.	Theoretical.	Mean Infantile Mortality.	Actual.	Theoretical.
84	9.7	8.9	76	9.5	8.9
96	8.8	9.8	85	10.0	9.9
105	10.4	10.4	95	10.9	11.0
115	10.7	11.2	105	12.0	12.1
125	11.8	11.9	114	13.1	13.1
135	12.8	12.7	124	16.2	14.2
144	14.3	13.3	134	17.5	15.4
154	13.0	14.1	145	20.5	16.6
165	18.4	14.9	155	23.5	17.7
175	21.7	15.7	163	25.3	18.6
185	23.9	16.4	175	28.0	19.9
194	26.3	17.1	186	33.2	21.2
201	25.7	17.3	192	34.9	21.8
214	29.4	18.6	205	38.3	23.3
225	36.7	19.4			
237	40.4	20.3			

The chief infectious diseases of children—namely, whooping-cough, diphtheria, and scarlet fever—however, also offer some information. In these diseases up to a definite age the child becomes gradually more susceptible to the disease while at the same time it becomes much less susceptible to death. On the immunity hypothesis just described, frequent small infections must thus tend to render the child more susceptible to an attack of the disease but less susceptible to a fatal attack. The decay in the death rate, however, is described by the terms of a geometrical progression. This suggests a law of its own quite independent of the variation of susceptibility. The whole of the general argument of small doses producing immunity seems to me to be insecurely founded, and in one instance it can be definitely proved wrong. With small-pox an increasing immunity to the disease develops after the age of 15 years, and there is in this case no question of small immunizing doses being constantly present. The only case in which anything approaching experimental verification of the theory exists is that of diphtheria.

Having thus noted the physiological changes which take place, a further question remains to be investigated—namely, the progressive effect of an unhealthy environment on the development of a child. The usual measure of the effect of environment on child life is called the infantile mortality, which is the number of deaths out of each thousand births. All such measures are open to some statistical objection, but this measure is as good as any other and may be taken as a criterion. Taking this, then, as a criterion and arranging the registration districts in England and Wales in groups according to the order of the infantile mortality, and comparing the infantile mortalities of those groups with the mortalities in the following years of life, the progressive effect of an unhealthy environment may to some extent be estimated. It is found that, with each increment to the infantile mortality, the increment of the mortality in the second year of life is greater than the infantile mortality would lead you to expect. In mathematical language, a term in the square of the infantile mortality must be added. During this period, therefore, there is progressive deterioration in the child's life. The excess of the real values over proportionate values is shown in the accompanying table (Table II). The greatest effect seems to be about the age of 1·8 years. When the succeeding years of life are examined the difference becomes less marked, the factor multiplying the second power of the infantile mortality halving itself with each year of life until, when the age of 4 to 5 years is reached, increments in the mortalities are very nearly directly equivalent to increments in the infantile mortality. Whether this represents a gradual stiffening of resistance to disease with growth or whether it represents survival of the fittest is a matter on which it is difficult to express an opinion.

Dr. J. C. MCVAIL, in thanking and congratulating Dr. Brownlee for his paper, remarked that the author was in the singularly fortunate position of being at once a medical man and a mathematician, a rather rare combination. He would not venture to criticize or even discuss the paper, for it was one to read and study carefully.

PUERPERAL MORTALITY IN SCOTLAND.

BY

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MATERNAL mortality may be expressed in terms of maternal deaths per 1,000 persons living; more usefully in terms of maternal deaths per 1,000 women of child-bearing age—conventionally reckoned as from 15 to 45; but best and most accurately and conveniently of all, in terms of maternal deaths per 1,000 living births or 1,000 births of viable children. To secure accuracy for purposes of comparison, it is necessary to define the term "maternal deaths"; that term must obviously include deaths of all natures, alike those that have a definite connexion with child-bearing and those that have only a presumptive association therewith or none at all; and it must be arbitrarily restricted on the one hand to deaths occurring after a certain stage of pregnancy, and, on the other, to those occurring within a certain number of days after delivery. The former period may be put at seven months, the latter at twenty-eight days. This interval of four weeks has the advantage over the period of thirty days that the days of the week are an assistance to the memory; for example, if delivery takes place on a Monday, the period after which death ceases to be reckoned as "maternal" ends on a Monday also.

It is clear that these time limits secure uniformity for purposes of fair comparison at the cost of artificial and arbitrary distinctions. It is true that a certain proportion of deaths associated directly with the puerperal state will not ensue until more than four weeks have elapsed after delivery; but it is also the case that a number of maternal deaths occurring within twenty-eight days after delivery will have no essential association but merely a coincidental connexion with the fact of motherhood.

Fair comparison between the puerperal death rates in various countries or at various times can only be made if the method of expressing that death rate is the same in each case. There is reason to fear that this uniformity of method has not been achieved.

Further, comparative statements of puerperal mortality according to the specific nature of the cause of death can be reliably made only if every possible source of fallacy has been excluded. On first thought it may seem that the group of

septic puerperal deaths might be defined with some ease and precision; but reflection shows that typical puerperal septicaemia, a septic pneumonia in the puerperal period, a septic condition of remote origin (that is to say, local origin not connected with the organs of generation), an attack of acute infectious fever such as measles, or indeed of any pyrexial malady occurring at or soon after delivery or precipitating delivery—that these form a chain or series which it is not easy to sever artificially at any point.

With these reservations as to the inductions that may profitably and fairly be made from them, let me place before you some facts.

In the year 1919 the rate of puerperal mortality in England was greater than for any year since 1905—namely, 4·12 per 1,000 births. The regrettable pre-eminence of this rate over those of the previous thirteen years applied both to puerperal mortality as a whole and to the mortality from puerperal sepsis taken separately; indeed the increase of the whole puerperal mortality rate in 1919 as compared with that of previous years was preponderantly due to septic disease.

For the year 1920, in England, the total maternal mortality rate was the same as in the previous year, 4·12 per 1,000 births; but while the rate for deaths from "other accidents and maladies associated with maternity" fell from 2·36 to 2·25 per 1,000 births, the rate for septic maladies associated with maternity (including phlegmasia dolens) rose from 1·76 to 1·87 per 1,000 births. These figures the Chief Medical Officer of the Ministry of Health regards, not unnaturally, as extremely disquieting. In his annual report for 1920 he points out that in that year the number of notifications of puerperal fever in England was 2,898 and the deaths were 1,750, "which indicates either that the fatality was extremely high or, what is more likely, that the notifications did not represent the number of cases of puerperal fever which actually occurred"; and that the deaths from puerperal fever by no means represent all the evils for which it is responsible. The Chief Medical Officer's report states that "undoubtedly the solution of this grave situation is mainly dependent upon improved midwifery."

During the decade 1911-20, 6,913 deaths ascribed to diseases and accidents of pregnancy and parturition were registered in Scotland. Of these, 1,831—fully one-fourth—were certified as due to puerperal sepsis. The annual rates for each category per 1,000 births are shown in the following table:

Year.	Deaths from Puerperal Sepsis per 1,000 Births.	Deaths due to other Diseases and Accidents of Pregnancy and Parturition per 1,000 Births.	Year.	Deaths from Puerperal Sepsis per 1,000 Births.	Deaths due to other Diseases and Accidents of Pregnancy and Parturition per 1,000 Births.
1911	1·42	3·74	1916	1·69	4·03
1912	1·57	3·92	1917	1·72	4·26
1913	1·33	4·55	1918	1·15	5·85
1914	1·85	4·18	1919	1·41	4·80
1915	1·94	4·19	1920	1·77	4·36

From the above it may be seen that the death rate from puerperal sepsis in Scotland in three of the years of the last decade is higher than it was in England in any year of the same period save the last. Moreover, there is good reason to believe that in Scotland, at least, some of the deaths which might properly be certified as due to puerperal sepsis are so certified as to fall into the group of "other diseases and accidents of pregnancy and parturition."

In Glasgow the number of cases of puerperal fever *notified* in the years 1914-19, the proportion per 1,000 births, and the number of cases terminating fatally are as follows:

Year.	Cases Notified.	Proportion per 1,000 Births.	Fatal Cases.
1914	218	7·4	81
1915	188	6·7	73
1916	195	7·2	69
1917	164	6·8	51
1918	168	7·1	45
1919	182	7·0	53

From this table it appears that out of the total of 1,115 cases notified in the six years, 372, or almost precisely one-third, proved fatal. From this high case-mortality rate it is clear that, as a rule, only those cases that are of considerable gravity or threaten to have possibly a fatal issue are notified. But the proportion of deaths to notifications (33·3 per cent.) is in satisfactory contrast to that previously quoted for England, where in 1920 the proportion of deaths to cases notified was fully 60 per cent.

In Glasgow for the five years ending 1919, the notified cases of puerperal fever were attended as follows:

By doctor	120
By midwife	189
By nurse and doctor	89
By institutional nurse	43
In institution	38
Others (including cases from outside the city)	21

No apportionment of blame can be based upon these or similar statistics, since (1) the total number of confinements in each class is not shown; (2) institutional cases may be and doubtlessly frequently are infected before admission to hospital; and (3) midwives unaided attend normal cases only, while doctors not only have in their own charge a larger proportion of difficult or abnormal cases than midwives have, but also render assistance to midwives in their difficulties. I am assured, however, that in special institutions such as maternity hospitals, where, of course, labour is attended with all due precautions as regards sepsis, it is rare or unknown for cases to develop puerperal sepsis unless opportunity of acquiring such infection had occurred prior to admission.

The Fourth Annual Report (for the year 1920) upon the Administration of the Midwives (Scotland) Act, 1915, in the Middle Ward District of the county of Lanark shows that 61 cases of puerperal sepsis were notified out of 7,562 births, or about 0·8 per cent.; 54 per cent. of these occurred among cases attended by medical practitioners. Cases of notified puerperal sepsis occurred in the practice of doctors at the rate of 8·3 per 1,000 births (one case per 121 births), in the practice of midwives at the rate of 7 per 1,000 births (one case per 143 births). These figures have to be interpreted in the light of the proviso already stated.

In Scotland, for the year 1919, as has been stated, the total death rate from puerperal conditions per 1,000 births was 6·21. That proportion is maintained with approximate equality in the various parts of the country.

For the larger burghs it is	6·4
For the smaller burghs it is	5·9
For the country districts it is	6·2

Among the cities and large burghs it ranged, in that year, from 4·6 in Paisley to 8·2 in Edinburgh. These figures deal with the total puerperal death rate; septic conditions accounted for 23 per cent. of the whole.

In a recent article (April, 1922) on the infant and maternal mortality in Montana, issued by the United States Public Health Service, wherein the maternal death rate is expressed in terms of the female population of child-bearing age (15-44), it is stated that for the four-year period 1910-13 and among eleven European countries the rate ranged from 29·3 deaths per 100,000 in Sweden and 32·0 in Norway, to 62·2 in Scotland and 63·8 in Belgium.

It is further stated that (expressing the rate in deaths per 1,000 births), in 1910, in fifteen foreign countries the highest rate recorded is from Scotland with 5·7, the lowest Italy with 2·4. (These figures are given primarily in order to furnish a basis of comparison with similar statistics for the State of Montana and the United States generally.)

It may be noted that in the United States, as here, septic conditions cause about one-fourth to one-third of all the deaths associated with the puerperal state.

In New Zealand, according to the official periodical of the Ministry of Health of that country, the mortality associated with childbirth and the diseases of pregnancy has remained high for several years and has recently been rising. The rate in 1920 was 6·48 per 1,000 live births. For the last quinquennium 36 per cent. of the average maternal mortality was due to puerperal infection. A committee specially appointed to deal with these alarming figures makes a number of recommendations, of which one is that "every case of maternal death shall forthwith be personally investigated by the medical officer of health, who shall report to the Director-General of Health"; and another that "every case of notified puerperal sepsis shall be forthwith personally investigated by the medical officer of health."

In the city of Aberdeen since the beginning of 1917 a full inquiry has been made, so far as practicable, regarding every death of a woman occurring within four weeks of confinement. During the five years in which such inquiry has been made, the total puerperal death rate and the septic puerperal death rate, per 1,000 births, have been respectively as follows:

Year.	Total puerperal death rate per 1,000 births.	Puerperal sepsis death rate per 1,000 births.
1917	9·8	2·7
1918	7·9	2·1
1919	6·7	0·3
1920	6·0	1·0
1921	6·0	1·4

From the annual report for the year 1920 of the Chief Medical Officer of the English Ministry of Health (already repeatedly referred to) it is learned that an investigation into the whole question of maternal mortality in England has been arranged for. In New Zealand, as I have mentioned, a commission was appointed to deal with the subject and has reported. It would seem that in this country of Scotland also inquiry regarding the causes of the high rate of maternal mortality, and the means of lowering it, might be desirable.

DISCUSSION.

Dr. HERBERT JONES regretted that Colonel Dewar had not expressed his own views as to the remedy for the deplorable conditions he had detailed. He had related what was being done in New Zealand, and had quoted Sir George Newman's dictum that "the solution of the situation was mainly dependent upon improved midwifery." But was that the case? We had had improved midwifery now a good many years, but not much lessening of puerperal sepsis. We were too apt to forget the importance of removing insanitary surroundings — providing water supplies to every house, removing manurial accumulations, etc. It could not be expected that the necessary standard of cleanliness could be achieved in cottages where every bucket of water required had to be carried 100 or 200 yards.

Dr. SHANNON (Maternity Hospital, Glasgow) said that he was of the opinion that incidence of sepsis would be reduced if every case was looked upon as a surgical operation and the same care exercised. He insisted on the better teaching of obstetrics and urged that longer time should be spent by the student in his training of midwifery from its clinical side. He deprecated the so frequent use of forceps and urged that nature should do its job. He thought all major cases of obstetrics should be treated in hospital or by the specialist.

Lieut.-Colonel F. E. FREMANTLE, M.P., doubted if any share in blame for the increased puerperal mortality should be attributed to sanitary conditions. Surgical operations were now done in most insanitary conditions, stress being laid on the need of personal asepsis and little on the sanitary character of surroundings. It might be suggested that the improvement first resulting from the operation of the Midwives Act was due to the use of antiseptics and to aseptic teaching, and that the recent change for the worse might be due to an increased practice of vaginal examination, owing to the increased knowledge by midwives and by the public of what could be learnt thereby. In any case he believed the personal element would best repay investigation as accountable for the increase in puerperal mortality.

Dr. PICKEN (M.O.H. Cardiff) drew attention to the importance of not unduly incriminating the midwife in this matter. The majority of cases appeared to occur among abnormal cases where medical practitioners found it necessary or advisable to adopt instrumental interference. In this disease home sanitation seemed to be of less importance than specific prevention by improved midwifery.

Dr. MORRIS (M.O.H. Neath) protested against laying the fault at the door of the medical practitioner. Thirty years ago maternal morbidity was extremely great. To-day it was almost non-existent. Midwifery practice was in need of improvement, but domestic sanitation was of less importance in its effect on incidence of septic infection. There was great need of improving the conditions of livelihood of midwives.

Dr. LEWYS-LLOYD (C.M.O. Merioneth) protested against the loose phraseology used in assigning blame to midwives or to doctors. The number of cases occurring in any area should be correlated with the number attended by doctors or midwives, alone or together.

Nurse BARKER (Inspector of Midwives, Glasgow) caused some amusement by stating that midwives often came to her "in tears" because of the injuries done by doctors in the inconsiderate use of forceps. She was of the opinion that more patience should be exercised and instruments resorted to less frequently in an unnecessary attempt to assist nature.

Dr. DEWAR, in reply, said that as a civil servant his mouth was sealed so far as suggesting a remedy, even if he knew one. The doctor in attendance might occasionally be guilty in a physical sense, but he was often the victim of circumstances. The whole subject was one that demanded close investigation.

DISCUSSION ON DEFECTS IN SCHOOL CHILDREN.

OPENING PAPER

BY

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IT is my intention, in the time at my disposal, to deal with the diseases affecting school children, more especially the 5-year-olds.

In the first place I shall draw your attention to the conditions disclosed by the routine medical inspection of entrants to our schools, and afterwards to the consideration of the conditions which produce crippling at school age. I use the word "crippling" in its widest sense, in fact to cover all conditions which so affect the health of the child as to prevent his being educated in the ordinary school. The figures which I shall give you are obtained from the results of routine examinations carried out during the session 1920-21, and also from the medical reports on those children found unfit for attendance at ordinary schools during the same period.

The total number of children on the register in the session 1920-21 was 198,282—the average attendance being 170,522, or 86 per cent.; 15,605 children were examined at the age of 5 (7,828 boys and 7,777 girls), and the conditions enumerated in the following table (p. 347) were disclosed.

These are the conditions found among the 5-year-old children attending ordinary schools. Let us now consider the conditions found amongst these children who for one reason or another are unfit to attend school. When the attendance officer finds that, owing to alleged disability, certain children have not been enrolled at any school he arranges for their examination, so that they may be allocated to special schools, or entirely exempted from school attendance if necessary. During the session 1920-21 out of a total of 1,252 children so examined 454 were 5 years old. Before proceeding to analyse the conditions found, I would explain that in the following cases, where two or more conditions are present in the same child, only the primary crippling cause is referred to; 454 children of 5 years of age were examined in this way, and the following conditions found:

Rickets	263=57·9%
Non-pulmonary tuberculosis: "bones and joints affected in 22, glands in 12, abdominal tuberculosis 5, skin infected in 2" ..	41=9·0%
Lung conditions: "chronic bronchitis 26, suspected phthisis 3, empyema 1" ..	30=6·6%
Mentally defective: "3 idiot and 26 imbecile —2 mongols and one a cretin"	29=6·3%
Nervous diseases: "infantile paralysis 13, hemiplegia 5, epilepsy 5, spastic paraplegia 2, chorea 1, neuroses 8"	34=7·4%
Anaemia and malnutrition	18=3·9%
Valvular heart disease: "5 congenital, 3 acquired"	8=1·7%
Eye diseases: "strumous ophthalmia 9, congenital cataract 1"	10=2·2%
Congenital deformities	11=2·4%
Deformities the result of injury	4
Hernia	2
Osteomyelitis	2
Chronic eczema	1
Deaf-mute	1

Age Group 5 Years.	Boys.	Girls.	Totals.	Percentage
Number of Children examined... ...	7828	7777	15,605	
Cleanliness:				
Head verminous	165	1336	1501	10.2
Body verminous	32	33	65	0.4
Condition of Skin:				
Head: Ringworm	17	11	28	0.1
,, Impetigo	133	113	246	1.5
,, Favus	—	1	1	—
,, Other diseases	43	27	70	0.4
Body: Ringworm	5	5	10	—
,, Impetigo	36	28	64	0.4
,, Scabies	20	36	56	0.3
,, Other diseases	15	34	49	0.3
Average height in inches (Anthropometric Committee's standard in brackets):	40.2 (41.0)	39.8 (40.2)	—	—
Average weight in lb.	35.9 (40.8)	38.1 (39.6)	—	—
Nutrition: Bad or very bad	501	590	1091	6.9
Teeth:				
1 to 4 decayed	4351	4417	8768	56.1
5 or more decayed	1593	1417	3010	19.2
Throat:				
Tonsils: S. enlarged	576	621	1197	7.6
,, M. enlarged	277	220	497	3.1
Lymphatic Glands:				
Submaxillary: P. enlarged... ...	450	643	1093	7.0
,, M. enlarged ...	29	22	51	0.3
,, Suppurating ...	2	2	4	—
,, Cicatrices	10	8	18	0.1
Cervical: P. enlarged	402	660	1062	6.8
,, M. enlarged	18	56	74	0.4
,, Suppurating	—	3	3	—
,, Cicatrices	16	14	30	0.1
External Eye Disease:				
Blepharitis	128	127	255	1.6
Conjunctivitis	39	52	91	0.5
Corneal opacities	15	7	22	0.1
S rabismus	185	204	389	2.4
Other diseases	21	23	44	0.2
Ears: Otorrhoea	95	102	197	1.2
Hearing: Slightly deaf	42	55	97	0.6
Markedly deaf	5	6	11	—
Speech: Defective articulation / Stammering ...	113	61	174	1.0
Heart and Circulation:				
Organic disease—Congenital ...	10	11	21	0.1
,, ,, Acquired ...	43	40	83	0.5
Functional disease	28	30	58	0.3
Anaemia	129	136	265	1.6
Lungs:				
Chronic bronchitis	544	490	1034	6.6
Tuberculosis	—	—	—	—
Tubercle suspected	4	3	7	—
Nervous System:				
Epilepsy	3	—	3	—
Chorea	1	—	1	—
Infantile paralysis	6	7	13	—
Other diseases	13	12	25	0.1
Tuberculosis (Non-pulmonary):				
Glandular...	4	2	6	—
Bones and joints	4	6	10	—
Abdominal	5	2	7	—
Skin	3	—	3	—
Rickets:				
Slight	71	71	142	0.9
Marked	421	390	811	5.1
Knock knees	143	177	320	2.0
Bow legs...	225	192	417	2.6
Curved tibia	104	71	175	1.1
Pigeon breast...	44	9	53	0.3
Deformities:				
Congenital	10	5	15	—
Acquired (non-rachitic)	16	11	27	0.1

Rickets.

From these figures there emerges, first of all, the striking fact that at 5 years of age 58 per cent. of the crippling found to exist in school children is due to rickets, and to rickets of the most pronounced type. The children affected are twisted and deformed, stunted in body, and retarded in mental development. Many of them are quite unable to walk, or even stand. After a few months in our special schools many of these children improve markedly in their general physical condition, feel fit and well, and for the most part can run about—a striking contrast to their helpless state at the time of admission. Unfortunately, however, their deformities remain, although in later years even these improve in varying degree.

Now, whatever may be your views on the causation of rickets, whether you agree with Professor and Mrs. Mellanby that it is due to the deficiency of fat-soluble vitamins, or with Professor Noël Paton, Dr. Leonard Findlay, and other workers in the Glasgow School, that it owes its origin to lack of fresh air, sunlight, and exercise, you will, I am sure, agree with me that there is something seriously wrong when a disease, which makes its appearance at such an early age and is so eminently curable, is still found in its acute form producing such an enormous percentage of the total crippling found at the age of entering school.

Over forty years ago my father, Dr. R. Wilson Bruce, who had an exceptionally large and unique experience of the conditions existing among children in Glasgow, both as medical officer to the school board of Glasgow and as medical superintendent of Eastpark Home for Infirm Children, came to the conclusion after observation of a large number of rachitic families, that the constant factors in the causation of rickets were overcrowding, hermetically sealed windows, and lack of sunlight—the mothers in the majority of cases being unable or unwilling, either because of weariness or laziness, to take the children out. Nowadays the education authority has powers to treat and feed all necessitous cases, and it may be somewhat difficult to decide how much of the rapid improvement noticed in rachitic children attending special schools is due to the feeding and cod-liver oil supplied, and how much to the superior hygienic conditions under which they spend a large part of their day. When I was first appointed medical officer in charge of the special schools under the former school board of Glasgow these powers did not exist, and in consequence children whose parents were unable or unwilling to pay for the feeding had to go without. Children suffering from rickets who were not receiving feeding nevertheless made marked progress towards recovery. The very fact of their being taken from their dark stuffy homes and brought into the bright, cheerful, well-ventilated schoolrooms had undoubtedly a curative effect. Another point which I have noticed is that once rachitic children have been fairly set on their feet by attendance at special schools, they very rarely relapse, although they return at once to ordinary schools and their old home and feeding conditions. This I attribute to the fact that once they are able to run about sufficiently well to climb up stairs to their three or four storied tenement houses, the children see to it themselves that they get plenty of fresh air and exercise.

While I do not for a moment doubt that prolonged lactation, defective dietary, and other debilitating influences play their part in the causation of rickets, I cannot help feeling that the reason that so much active rickets is present among school children at the age of 5 is that nothing short of early removal from their unhygienic overcrowded homes will be of any service in the prevention or curing of this disease. This measure I am afraid in the present state of the country's finances is outwith the bounds of practical politics. These opinions have been greatly strengthened by the researches of Professor Noël Paton, Dr. Leonard Findlay, and others of the Glasgow School, and more recently by a paper on rickets in India read before the Royal Medico-Chirurgical Society of Glasgow by Dr. Harry Hutchison, in which he proves that in India rickets is only found among the wealthy purdah classes in spite of a plentiful dietary rich in vitamins, whereas among the poorer classes who practically live in the open air it does not exist.

Tuberculosis.

The next most frequent cause of crippling among 5-year-olds is tuberculosis, which is responsible for 9 per cent. of the total crippling. There is, of course, no doubt that the ideal treatment for these cases is prolonged residence under hygienic conditions in suitable sanatoriums, with plenty of fresh air and sunlight. Unfortunately in this part of the country the sunlight is a very variable quantity and we can hardly expect the brilliant results obtained at the Treloar Cripples' Hospital, Alton, Hants.

For many years in Glasgow there was, with the exception of the limited accommodation at Eastpark Home, no intermediate place between the general hospital and the special school for the prolonged treatment of surgical tuberculosis, but a short time ago the Corporation of Glasgow opened a large hospital at Robroyston where these cases can undergo treatment for long periods under the best hygienic conditions. Arrangements have been made in conjunction with the medical officer of health for the education of school children in Robroyston Hospital.

If we accept the statement that two-thirds of all surgical tuberculosis is due to bovine infection, it behoves us to see to it that our milk supply is beyond suspicion.

Lungs.

(*a*) *Tuberculosis.*—When we come to consider diseases of the lungs as a cause of crippling, we find that pulmonary tuberculosis is conspicuous by its absence. Routine medical inspection revealed no evidence of definite pulmonary tuberculosis and only seven suspected cases out of a total of 15,605 children examined. Even among the crippled children at this age pulmonary tuberculosis was not definitely found though it was suspected in 0·6 per cent.

(*b*) *Bronchitis.*—Chronic bronchitis is responsible for 6 per cent. of the whole crippling. These cases of chronic bronchitis range in severity from cases of winter cough accompanied by snoring and wheezing rhonchi to the most advanced cases of bronchiolectasis and bronchiectasis with large cavity formation, fibrosis and contraction of the lung. It is these latter cases which are responsible for most of the lung crippling; they are almost invariably the result of bronchopneumonia following measles, whooping-cough, and influenza, and are very apt to be diagnosed phthisis pulmonalis, especially when seen soon after the bronchopneumonia, when emaciation is marked. After long observation of many of these cases I have come to the conclusion that they are not tuberculous, the spit is invariably negative, and in spite of the most extensive cavity formation the general health improves under favourable conditions, and it is no unusual thing to find a child after prolonged treatment, apparently in robust health, with a chronic basal catarrh of both lungs associated with fibrotic change. Many of these cases I have submitted to my friends the tuberculosis officers for further observation and inquiry, and their conclusions have agreed with mine—namely, that the cases are non-tuberculous.

In my experience, then, phthisis pulmonalis is rarely found in children at 5 years of age, and I attribute the high incidence of this disease reported from some districts to the inclusion of these cases of chronic bronchitis and fibrosis.

Nervous Diseases.

As I have already mentioned, nervous diseases are responsible for 7·4 per cent. of the crippling found at this age. Unfortunately there is very little that can be done for these cases except in so far as we can prevent the formation of contractures in hemiplegias and spastic paraplegias, and by supplying suitable apparatus in the case of infantile paralysis enable the child to make the most of what power he has.

Mental Deficiency.

Mental deficiency comes next in the order of frequency, with a total percentage of 6·3. The cases which are diagnosed at this age are, of course, gross cases of low grade amentia which are obviously for institution treatment and care. Unfortunately these do not nearly account for all the mental deficiency present among 5-year-olds. The higher grade cases which exist cannot be diagnosed till the child has been some time under observation in the infant department. In Glasgow we do not care to label the higher grade cases mentally defective till they have been given a two years' trial among normal children.

Anaemia and Malnutrition.

The cases of anaemia and malnutrition, which account for 3.9 per cent. of the total crippling, are those which show no symptoms of other disease, the debilitated conditions usually following on pneumonia or one of the infective fevers. In some of the cases a tuberculous family history can be elicited.

Miscellaneous.

The remaining 9 per cent. of crippling, due to eye conditions, mostly strumous ophthalmia, a few cases of heart disease—the acquired of those due to scarlet fever and rheumatism—and other miscellaneous conditions such as congenital and acquired deformities, need not be discussed in detail.

From the facts that I have laid before you you will see that by far the largest amount of crippling is due to entirely preventable causes. As we know rickets, surgical tuberculosis, anaemia and debility, and strumous ophthalmia to be curable under ideal hygienic conditions, I am convinced that it is by the same means that these diseases could be prevented, and that those cases of chronic bronchitis which develop so frequently in debilitated children after bronchopneumonia would be reduced to a minimum. What we want, therefore, is first of all the provision of open spaces to allow of the free access of sunlight, a tubercle-free milk supply, better feeding conditions, the provision of good houses with every convenience for cleanliness, and the total abolition of the slum.

DISCUSSION.

Dr. MILLER (C.M.O. Radnor) commented on the comparatively small number of children with suspected phthisis, and inquired whether these were kept under observation. He also asked if Dr. Bruce could furnish any information as to the prevalence of rickets amongst breast-fed infants.

Dr. MORRIS (M.O.H. Neath) expressed the opinion that lack of exercise had much to do with the causation of rickets. He strongly condemned the carrying the baby in a shawl wrapped tight against the mother, a custom which he noticed was as prevalent in Glasgow as in South Wales. The "shawl" babies always had rickets; the pram was infinitely better.

Dr. BRUCE, in reply, stated that all cases of suspected phthisis or malnutrition were kept under observation at the clinics before being passed on to the Tuberculosis Department. Some had been under observation for nine years without showing definite signs of tuberculosis. He could always tell by a child's legs whether it was a "shawl" baby or a "pram" baby, but the ricket-producing class seldom if ever possessed a perambulator. He frequently found rickets amongst the breast-fed babies, but could not at the moment give exact figures.

MATERNITY AND CHILD WELFARE IN SCOTLAND.

BY

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THE object of this paper is to furnish a short record of the steps taken by local authorities in Scotland to create maternity and child welfare services under powers conferred upon them by the Notification of Births (Adoption) Act, 1907, the Notification of Births (Extension) Act, 1915, and the Maternity and Child Welfare Act, 1918.

In the application of the 1915 Act to Scotland very wide powers were conferred on the local authorities concerned, in that they were empowered "to make such arrangements as they think fit and as may be sanctioned by the Local Government Board for Scotland for attending to the health of expectant mothers and nursing mothers and children under five years of age within the meaning of Section 7 of the Education (Scotland) Act, 1908."

By a circular letter issued in 1915 the Local Government Board for Scotland invited local authorities to "submit schemes of arrangements in terms of the Act."

For the purpose of inspiring and assisting local authorities a comprehensive memorandum expounding the purpose of the 1915 Act was issued in 1916. To this were appended the regulations governing the payment of the 50 per cent. grant allowed by the Treasury. These regulations, apart from the clauses securing the administrative control of the Board retained in the regulations of later date, are rendered interesting when regarded in the light of the developments of after years by the nature of arrangements therein specifically excluded from grant. These were (1) residential treatment in hospitals, (2) operative treatment in hospitals, and (3) expenditure on food and milk.

For the further assistance of local authorities, a circular letter was issued in October, 1916, defining more clearly the nature of the arrangements that might suitably be included in schemes. On the terms of this circular, and on those of the circular letters of 1917 and 1918 containing revised regulations under which grants would be payable, have been based the schemes submitted for approval by local authorities.

These schemes, which only include arrangements made for attending to the health of expectant mothers and nursing mothers and children under 5 years of age, follow therefore certain general lines that can best be indicated by summarizing the expenditures defined by the regulations as grant earning.

These are, in short, expenditures on (1) salaries of medical officers, health visitors, nurses, and midwives engaged in maternity and child welfare work; (2) the provision for necessitous women of a midwife, or of a doctor for illness connected with pregnancy or aid during the period of confinement; (3) centres providing medical supervision and treatment; (4) institutions for the day care of children; (5) the temporary boarding out of children; (6) accommodation in maternity hospitals and provision for securing proper conditions for the confinement of necessitous women; (7) hospital accommodation for children; (8) accommodation in convalescent homes; (9) the provision of homes and other arrangements for attending to the health of children under 5 years of age whose parents cannot provide a satisfactory home for them; (10) experimental work; (11) educational work; (12) food to the necessitous; and (13) contributions made by the local authority to voluntary institutions.

Before expenditure on arrangements can rank for grant it must conform to certain conditions and be specifically approved by the central authority, now the Scottish Board of Health. Since 1918 there have been extensions of the regulations to admit the provision of nursing care and massage for children and the cost of accommodation and treatment in hospitals for cases of measles and whooping-cough.

During a period of acute distress occasioned in certain areas by unemployment in the coal-mining industry and the resulting trade depression, it became necessary for the central authority to define from time to time the conditions under which relief in the form of rations, food and milk, might be given to mothers and children. The special increase in expenditure due to the industrial crisis cannot be regarded as appropriate to a maternity and child welfare service carried on under normal conditions.

The absorption in the disbursement of relief of the attention of local authorities and of the members of their staffs normally employed in maternity and child welfare services, combined with the concurrent clamour for economy, has prevented the development of new services, but has not seriously interfered with the expansion projected in previous years and in course of being put into operation.

The population of Scotland (census 1921) is 4,882,288. The number of births in 1920 was 136,546, and the deaths under 1 year of age were 12,565. The infantile mortality rate in burghs varies from 0 to 208, and in county districts from 30 to 102. For 1921 the rate for Edinburgh was 96, for Glasgow 106, Aberdeen 108, and Dundee 114; for Scotland it was 90—the lowest rate recorded so far for the country as a whole.

Almost 3,000,000, or about three-fifths of the population, are maintained by the industries dependent on coal and iron centred in the Forth and Clyde valleys. They live for the most part in overcrowded conditions calculated to produce a high infantile mortality rate. It is therefore mainly in this area and in the cities of Dundee and Aberdeen that local authorities, supported by the pressure of public opinion, have since 1916 drafted schemes that are still in the course of development and go far towards providing an adequate service for the care of mothers and children.

The local authorities within the meaning of the Notification of Birth Acts, 1907 and 1915, are the 201 town councils, 8 county councils, and 99 district committees. Owing to the power to combine allowed by the 1915 Act as applied to Scotland, schemes fall into four groups, but there are differences in the nature of the schemes and in the extent to which particular services included have been developed, resultant on the diversity in the industrial character of the areas concerned.

Types of Schemes.

The following are the four types of schemes:

1. The one-burgh scheme, in which the administrative control is retained by the local authority. There are 84 burghs, 16 with a population over 30,000, with such schemes. The schemes of the smaller burghs within this group cannot be regarded as self-contained, since institutional accommodation has to be obtained without their areas.

2. The one-district scheme, in which local administrative control is retained by the district committee. There are six such schemes, situated in Dumbarton, Renfrew, and Lanark Counties. For the most part they are not self-contained, since institutional accommodation has to be obtained in other areas.

The most important of these one-district schemes is that of the Middle Ward of Lanark, with a 1921 census population of 218,789, and a birth rate in 1920 of 34.4. Its local authority, well known for initiative and progress, has since 1916 been gradually putting into operation an extensive scheme which, if expansion continues, should in course of time become self-contained. For the purpose of providing a maternity and child welfare service in this district, two medical officers and eighteen health visitors, including a superintendent of health visitors, are employed whole-time. Eight maternity and child welfare centres held in premises afforded by public halls that can be rented for the purpose are in operation. These centres are open once a week with a doctor in attendance for consultations, assisted by health visitors, and by voluntary workers who provide a supplementary social service. Close supervision is exercised over the midwifery service. A maternity hospital and training school for midwives has been established at Bellshill, with an annexe in the form of a hospital for infants at Blantyre. A rest and convalescent home for mothers and babies at Calderbank House completes the present arrangements.

3. The district combination scheme, in which burghs have combined with the county district in which they are situated. There are seven such schemes. In the Upper Ward of Lanark and in the districts of the County of Fife, administrative control is retained by the district committee. In Haddington County administrative control is delegated to committees on which the authorities concerned are represented. Twenty small burghs have thus secured economical services.

4. The county combination scheme. There are eleven such schemes sanctioned—namely, for the Counties of Aberdeen, Ayr, Berwick, Clackmannan, Dumfries, Kincardine, Kirkcudbright, Midlothian, Moray, Perth, and Stirling. Whilst the Aberdeen County scheme is administered locally by the county council, the other county schemes are administered by joint committees representing the authorities concerned.

All of the county districts and the majority of the burghs within these counties have entered the respective combinations, forty-one districts and fifty-six burghs being thus provided with services. In Clackmannan and Kincardine Counties all the burghs are within the combination, whilst in Moray, Dumfries, Berwick, and Kirkcudbright counties, Elgin, Dumfries, Duns, and Maxwelltown burghs respectively remain outside. Most burghs with a population under 5,000, realizing their inability unaided to furnish an adequate service, have sought economy and efficiency by combination with larger authorities. There still remain, situated for the most part in the northern and western sparsely populated areas where the infantile mortality rates are low even when judged by the present improved standard, forty-one burghs without child welfare services and seventeen counties in which no provision is made for the landward areas.

In order to bring into relief the results of the energy, initiative, and enterprise shown by the public health authorities during the succeeding years it is necessary to refer to the official provision existing in 1915.

Medical Officers and Health Visitors.

There were at that time, officially employed on duties dependent on the adoption of the Notification of Births Act, 1907, two women doctors and twenty-nine women visitors whole-time, and nineteen women visitors part-time. Now, in 1922, in addition to the medical officers responsible for the administration of the 108 sanctioned schemes, there are eleven medical officers employed whole-time on child welfare work—one each in Edinburgh, Dundee, Aberdeen, Greenock, and Paisley, four in Glasgow, and two in the Middle Ward of Lanark. There are at least sixteen whole-time medical officers of local authorities and twenty-six part-time medical officers of health taking an active practical part in maternity and child welfare work by serving as medical officers of clinics.

A large number of general practitioners are drawn within the services as medical officers of centres, whilst specialists are attached to hospitals established by local authorities and to other institutions included in schemes. Engaged officially in home visiting are 172 whole-time, 201 part-time, and approximately 800 voluntary health visitors. Inspection of midwives, which has resulted in a marked improvement in the standard in some areas, is performed by medical officers of health and by health visitors appointed to assist.

Maternity and Child Welfare Centres.

In June, 1916, there were 14 maternity and child welfare centres in Glasgow under municipal control; and, provided by voluntary effort, there were 5 in Edinburgh, 5 in Aberdeen, 3 in Dundee, and one in Motherwell, those in Aberdeen being in close touch with the public health department. There are now 166 centres almost entirely maintained by the public health authorities.

Institutions for the Day Care of Children under 5 Years of Age.

There has been no marked increase in the number of institutions of this type, but by the reconstruction of old buildings and the provision of new buildings for existing institutions, transferred from the voluntary associations by which they were established to the public health authority, the standard has been much improved. For example, a model day nursery, intended to replace one existing in unsuitable premises, has by its presence, converted, in the Cowcaddens, Glasgow, an ugly piece of waste ground, formerly a noisome slum, into a picture that delights the whole neighbourhood and charms every passer-by.

An old-fashioned square-built house with a large garden presented to Stirling Burgh and converted into a centre, day nursery, and, by the aid of the Carnegie United Kingdom Trust, a garden play centre, is another example of a beauty spot in a rude neighbourhood.

It must be deeply regretted by all workers familiar with the conditions of life for young children in slum areas, where children under 5 are kept in bed undressed, unwashed, and without toys, games, or other amusements, until mid-day, whilst the mother does her housework—the only available playground being the common stair or the gutter—that more effort has not been made by public health or education authorities to bring, by the establishment of nursery schools, within the reach of these little ones the ordinary training afforded by games and toys to the child of the middle class.

There is a model nursery school at the Phoenix Park, Glasgow, established by voluntary effort and now maintained by the public health authority. There are three in Edinburgh, established and for the most part maintained by voluntary effort. Toddlers' play centres serving a somewhat similar purpose exist to the number of six in Edinburgh, one in Stirling, and one in Elgin, established by voluntary effort, but, with the exception of that in Elgin, assisted by grants from the local authorities.

Institutional Accommodation for Maternity Cases.

Of the six maternity institutions existing in 1916, five have now some form of agreement with one or more local authorities and are thereby included in schemes. In conjunction with the local authority, an ante-natal annexe to the Aberdeen Maternity Hospital has been established. In agreement with the Edinburgh public health authority, the Royal Simpson Memorial Hospital has provided ante-natal beds and an ante-natal out-patient department of great benefit to the community. This hospital has also agreements with other local authorities in regard to the admission of cases from areas outside the burgh.

Agreements have been made by the Glasgow Maternity Hospital with the Glasgow Town Council and with other authorities for the admission of cases.

The increasing demand made for institutional accommodation for maternity cases has led to the provision of new institutions by local authorities. The district committee of the Middle Ward of Lanark has converted Bellshill Hospital into a maternity hospital of forty beds. The Town Council of Paisley has provided a maternity hospital of eighteen beds in Barshaw House, its own property situated in the public park. The Joint Maternity and Child Welfare Committee of the Ayr County Combination has twelve maternity beds in Seafield House Hospital, a mansion house purchased and equipped by the authority. Greenock Town Council converted a house gifted for the purpose into a hospital of six beds.

Maternity homes for normal cases, providing in all about forty-eight beds, have been established by Airdrie and Coatbridge, by Kirkcaldy, Dunfermline, and Dumfries.

Hospital Accommodation for Children under 5 Years of Age.

The large voluntary hospitals for sick children have not made official agreements with local authorities and are not directly included in schemes. They, however, deal with cases referred to them, that by their nature have a claim on in-patient or out-patient treatment. To meet a clamant want, special hospital provision for infants has been made by the local authorities of Aberdeen, Paisley, the Middle Ward of Lanark, and Ayr County, and has been secured in Dundee by arrangement with the infant hospital, and in Greenock by a small voluntary hospital partly maintained by and managed in close co-operation with the public health department.

The arrangements of local authorities generally are supplemented by a vast amount of voluntary effort of inestimable value, represented by organizations for the purpose of providing assistance in the clerical, social, and educative services of child welfare centres; by the provision of accommodation in hospitals, convalescent homes, and other institutions for mothers and children, utilized by local authorities for cases coming under their care for which they have not themselves made other provision; by nursing associations that furnish the part-time health visitors that are employed in rural areas; and by associations in Edinburgh and Glasgow that supply about 800 voluntary health visitors.

Various methods of procedure have been followed by local authorities putting into operation child welfare schemes, and that of Edinburgh may be regarded as one type. There the local authority, in accordance with the scheme drafted by the medical officer of health, proceeded to include and co-ordinate such voluntary associations and institutions within the burgh as were suitable and were willing to enter into an agreement. These included voluntary health visitors, infant health centres, consultations for women and children, dispensaries, day nurseries, nursing schools, play centres, hospitals, and homes for mothers and infants.

A policy of non-interference with the private management of institutions providing special services under terms of agreement, followed by the town council, encouraged institutions that were at first reluctant to do so to come into the scheme. In order to cope with the increasing work of the service, a whole-time medical officer was appointed and the clerical and whole-time health visiting staff increased. With a view to improving the standard of the service, premises were reconstructed, institutions were transferred to other premises, and additional centres opened. A beautiful home was provided for delicate children at Gogarburn. On the fusion of Edinburgh and Leith, the institutions provided by the latter town council automatically came within the scheme.

No report on maternity and child welfare services in Scotland would be complete without a reference to Motherwell, where since 1912 home visiting has been undertaken by a part-time service organized by the Motherwell Nursing and Ambulance Association on behalf of the local authority. As home visiting developed, an extension of the nursing service was needed to meet the requirements of the statutory work; and whereas in 1912 there were three nurses employed in district nursing, there are now thirteen nurses including a superintendent engaged in the co-ordinated service for voluntary and statutory home nursing and visiting. The new combined burgh of Motherwell and Wishaw, Clydebank, and Falkirk are the three larger burghs in which this arrangement obtains, the women employed in these home-visiting services being Queen Victoria Jubilee Nurses.

To Motherwell was offered the model maternity and child welfare centre bestowed on the Scottish people by the Carnegie United Kingdom Trust. This important institution includes a maternity and child welfare centre, a very complete treatment centre, a cleansing centre, and provision for a mothers' club and other suitable educative activities.

The scheme put into operation by the combining authorities of Ayr County presents certain points of interest, since it arranges for a maternity and child welfare service almost entirely staffed by part-time officers. The four district committees and the town councils of all the burghs within the county, except Ayr, Irvine, and Kilmarnock, agreed to combine and to exercise their powers through a joint committee containing representatives of the combining authorities, and fifteen co-opted members, of whom five must be women. The population of the area, including that of the burghs served by the arrangements made by the joint committee, is according to the census taken in 1921, 215,931, and the births were 5,722 for the year 1920.

In order to secure an adequate health visiting service, a County Nursing Association had to be brought into being, stations for district nurses fixed, and areas to be served determined until

the whole population of the county was grouped into areas for the purpose of being supplied with a nursing service. Nursing associations had to be constituted in the areas not provided with such. For the purpose of aiding in the creation of additional associations and the co-ordination and supervision of the statutory work of all the nurses, a superintendent of health visitors was appointed. There are now thirty-five stations for district nurses, and forty-one nurses are employed part-time in health visiting. Four whole-time health visitors are, however, also required for wide areas in which district nurses are not available. In burghs and mining villages twenty-six maternity and child welfare centres have been opened at which consultations by doctors in general practice are held, for the purpose of the prevention of defect and disease in mothers and children.

The combined local authorities have shown initiative and resource by establishing a maternity and a sick children's hospital at Seafield House, Ayr, where in an institution, equipped as a hospital, situated in delightful surroundings that will allow of future expansion, twelve maternity beds and accommodation for thirty-four children is provided.

A most interesting scheme is that of the Western District of Haddington, wherein the local authorities of the four burghs—Cockenzie, Haddington, Prestonpans, and Tranent—have combined with the district committee. The scheme is administered by a joint committee representative of the local authorities. Under this scheme the home visiting is carried out by three whole-time health visitors employed by the county council, who give part time to health visiting, part time to tuberculosis, and part time to school nursing. They therefore have the care of the children from birth to 16 years of age, and not only are valuable agents in the prevention of disease, but also have a most beneficial influence in the homes throughout the area. The value of the child welfare centres, three in burghs and three in mining villages, held in public halls with inexpensive equipment, with a doctor and health visitor in attendance, is undoubtedly greatly appreciated by the mothers of the community.

Hospital treatment is obtained by sending maternity cases to the Royal Maternity Hospital and by referring sick children to the Royal Hospital for Sick Children in Edinburgh.

DISCUSSION.

Dr. MCKAIL (Lecturer on Public Health, St. Mungo's College, Glasgow) applied a note of interrogation as to whither all this public health work tended. Was it towards the Spartan system of taking the children from the parents and doing everything for them? We should not drift into this without definitely visualizing the result.

Dr. H. BRACEY (Assistant Schools Medical Officer, Warwickshire) asked if Dr. Menzies had correlated the infantile mortality rates of different areas with the infant welfare schemes on the one hand and the general sanitation of the areas on the other, in order to discover the relative importance of the former and the latter in reducing infantile mortality.

Lieut.-Colonel FREMANTLE, M.P., hoped that Dr. Mary Menzies would not occupy too much of her time in mathematical inquiries, as suggested by Dr. Bracey, as these, as a rule, only proved what was already known. It was the existence of these appalling conditions which called forth the best welfare effort. Of the remarkable schemes recorded in the paper under discussion the most satisfactory feature was the use made of all the various agencies—national, municipal, voluntary, part-time and full-time. It was co-operation of this kind that led to efficiency. We must also remember that the greater the responsibility thrown on the parents the more likely was parenthood to be discouraged, the birth rate depressed, and the recruiting of the nation arrested.

Dr. MARY J. MENZIES, in reply, said that Dr. Fremantle had already given more than a sufficient answer to Dr. McKail and Dr. Bracey. Less than 1/10 per cent. of the population were engaged in looking after the others. The recent fall in the infant mortality rate for England had more than improved sanitation behind it. The sanitary improvements which had been going on for the previous thirty years had not been accompanied by a similar reduction in infant deaths. The infant death rate should be considered along with the defect rate amongst children admitted to school, and a fall in the former should be associated with a fall in the latter.

DISCUSSION ON INDUSTRIAL FATIGUE AND VOCATIONAL SELECTION ON A BASIS OF PHYSICAL INQUIRY.

OPENING PAPER

BY

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THE study of industrial fatigue is the study of a very complicated problem, and one beset by many difficulties.

In the first place, what do we mean by the term "industrial fatigue"? The words themselves connote, taking them reversely: "fatigue"—weariness, tiredness, or exhaustion from bodily labour or mental exertion; and "industry"—habitual diligence in any employment, either bodily or mental; steady attention, careful application, activity, assiduity. Taken together, they denote the worn-outness due to physical toil or bodily exertion or mental effort, either from its intensity or violence or from its continuance or protractedness. Such fatigue was undoubtedly common when the hours of labour were prolonged to twelve, fourteen, or even sixteen a day, and when heavy loads and exhausting tasks were almost entirely moved or accomplished by the use of human power. Even to-day there are numerous examples of arduous toil, while, on the other hand, the hours of labour are, for the most part, markedly shortened. This kind of fatigue is such that it tends to produce physical deterioration in those engaged in it, so that the wastage is excessive, and, if not absorbed by lighter industries in the neighbourhood, leads to heavy calls on the communal provision for the disabled. It therefore borders on the pathological, because it taxes the recuperative powers from day to day and from week to week. The worker is thus always partially intoxicated with the products of exertion, excretion lagging behind production. In this state he is more liable to the commoner infections and in a less fortunate position to bear up against them. His resistance to infection is depressed and his response to attack is enfeebled. While other consenting causes are at work in effecting these results—namely, the unhygienic conditions often associated with indoor manufactures—the toxaemia is probably the most important individual cause. The provision of more fresh air inside the factory might only result in increased production of effort and so of toxin, whereas the tiredness resulting from the toxaemia makes the worker unwilling to exert himself further in his leisure to take "exercise" in the open air.

But it is undoubtedly true to say that the present generation is emancipated from much irksome labour that the preceding ones could not avoid, however much they might wish to do so. And in the last few years the reduction of the hours of labour to eight in many employments has, with the increasing use of motive power, practically eliminated this exhausting form of fatigue in these, and reduced the opportunities of its study very considerably. With the improved conditions, the problem has developed along physiological lines. The ill effects of the fatigue of exhaustion were often marked and obvious: those of the minor form are mostly subjective and personal to the worker and therefore not easily recognizable to the observer. It has thus been necessary to redefine the meaning of the term "industrial fatigue," and the definition now in general use is that of the Health of Munition Workers Committee, to wit, "the sum of the results of activity which show themselves in a diminished capacity for work"; or, to paraphrase this somewhat sibylline utterance, "activity, mostly muscular in character, but with the attendant and necessarily associated nervous action, when persisted in, as in the performance of a definite task or amount of work, produces consequent changes in the bodily structures involved, which in their accumulated effects reduce the rate of output of work." In some forms of activity this diminution of power or capacity is readily observable and can be used as a measure of the "industrial fatigue" produced.

It is needful to remind ourselves that "fatigue" in some degree follows every action of the human organism. When the rate of its production does not exceed the rate of its removal by the appropriate mechanism, then activity might be indefinitely prolonged. As a matter of fact, however, there is

always a lag in its removal, rest of the affected parts being an absolute requirement for full repair. If the fatigue is in reasonable measure, the nightly rest is sufficient to bring back the vivacity, and the person starts refreshed to his labours. Any daily lag can usually be overtaken by the weekly rest-day, which has no doubt been evolved from long observation by mankind as a necessity for man and beast when working to a daily programme. Otherwise, there are large bursts of output of energy, followed by pauses or rests.

The limitation of industrial fatigue to this minor form has this result, that a considerable body of research of past years is already available for application if the various interested parties are willing to utilize it. "All that is new is not true, and all that is true is not new" is an aphorism to be well remembered in these times. Numbers of men have applied themselves to the problems of the fatigue of exercise and work in the past two generations, and some have left valuable observations thereon. Unfortunately, much of the applied knowledge has perished with the persons themselves, belonging to that vast amount of discovery which is made in each generation but is not transmitted in permanent form.

Alongside of all this is the work of the physiologists, such as Waller, the inventor of the dynamograph, Mosso of the ergograph, and many studies in fatigue which have been widely applied in the field of education. In a series of researches in the industrial field Professor A. F. Stanley Kent has brought all this knowledge to bear in a masterly way on actual working conditions. Numerous succeeding observations have served to confirm and extend these, and there exists at present a well-attested body of knowledge concerning what are the best industrial conditions for many employments: the next step is to put them into practice. But that, unhappily, is not yet, for the present confused economic conditions have dealt a death-blow to many welfare schemes and the day of deliverance is deferred. The field of usefulness will thus be limited to ameliorating the extremely defective conditions where they exist, and in assisting in those trades and industries where the economic pressure is not so prohibitive. Not uncommonly, the occupations in which interference is most needed are those in which least is allowed, whilst in many luxury trades, with admirable conditions, the provision of extra comforts and facilities is spontaneous and considerable.

The work begun under the Industrial Fatigue Research Board in 1918 opened a promising field in which much useful spade-work has already been accomplished. This is still largely in the observational stage, and a considerable time must elapse before accurate deductions can be arrived at. It will be useful to quote the terms of reference to this Board, as a basis for further remarks:

> "To consider and investigate the relations of the hours of labour and of other conditions of employment, including methods of work, to the production of fatigue, having regard both to industrial efficiency and to the preservation of health among the workers."

When we proceed to attack these problems, certain difficulties at once arise. In some industries the pace of work is made by the individual, in others by the machine; in some the work is arduous, in others light; in some the output is easily measured, in others this is difficult; and so on. Other factors emerge which disturb the solution—namely, the differences in original endowment of strength and vitality among the workers; the varying reactions to their work and environment; the home conditions, especially whether work is demanded there after the day's toil; and the social habits in regard to rest, sleep, exercise, food, and amusements, all of which cast an influence on the amount of work done, the attention bestowed on it, the liability to accident, and the incidence of sickness. The many possible combinations and variations among all these parts of the individual's life-cycle make comparisons from worker to worker a matter of difficulty, and enforce the need for caution in drawing conclusions. As the reporter wisely says on page 6 of the Second Annual Report:

> "The difficulties of industrial research of this kind are formidable, and can only be fully realized by such as have had actual experience of it. Almost the whole of the investigations deal with a number of variables, none of which can be wholly controlled, and consistent results can only be secured by taking immediate advantage of opportunities as they offer, which under the industrial conditions of the last few years may suddenly lapse before investigation is complete."

Let us, then, "consider and investigate the relations of—

(*a*) The hours of labour,
(*b*) Other conditions of employment,
(*c*) Methods of work,

to the production of fatigue, having regard both to industrial efficiency and to the preservation of health among the workers."

A. *The Hours of Labour.*

The claim by the coal miners for an eight-hour day, made statutory in 1908, familiarized the nation with this part of the problem—namely, the consideration of the hours which should be worked at arduous employments. The seed thus sown was suddenly ripened into fruit in the post-war period, when, early in 1919, the adoption of an eight-hour day became an accomplished fact in most of the industries in this country. Incidentally, the shortening of hours worked raises the important questions of the arrangement of spells of work, rest pauses, and pace of work, as well as output and wages inquiries. The whole subject is thus intimately bound together, and interference with a part involves the whole. Accepting the eight-hour day, and leaving aside any economic considerations, what is the best division of the hours of the day between work and food and rest and sleep? To bring the matter to a point, I venture to put forward the following alternative arrangements, based on a wide variety of reasons, as the most suitable. I prefer the first, as conforming more to established meal hours in the general life of the community. Other reasons are indicated in the argument.

Rise, wash and dress; light breakfast	6 a.m.	7 a.m.
Morning spell of work ..	7 to 9 a.m.	8 to 10 a.m.
Breakfast and rest pause ..	9 to 10 a.m.	10 to 11 a.m.
Forenoon spell of work ..	10 a.m. to 1 p.m.	11 a.m. to 2 p.m.
Dinner and rest pause ..	1 to 2 p.m.	2 to 3 p.m.
Afternoon spell of work ..	2 to 5 p.m.	3 to 6 p.m.
Tea and rest pause ..	5 to 6 p.m.	6 to 7 p.m.
Rest and recreation ..	6 to 10 p.m.	7 to 11 p.m.
Sleep	10 p.m. to 6 a.m.	11 p.m. to 7 a.m.

The maximum working spell shown above is three hours. For work requiring steady application and attention, I would reduce this to two and a half hours. Where the work is intermittent, it may be lengthened to three and a half hours, but certainly not to four hours. Even where the duties are so mild as to make four-hour spells possible, there are other reasons why we should prefer the shorter period. Want of variation and confinement induce languor and dullness, and continuance of work thereafter can only be done by the exercise of superior or excessive mental stimuli, and the resulting fatigue is more slowly recovered from. This is more observable in work accomplished in fixed—that is, in sitting or standing—positions, and occasioning local fatigue of hand and eye. In arduous work, a four-hour spell should not be allowed where the labour is continuous. In any case, the work should be arranged with frequent pauses to allow of rallying. Certain occurrences in such employments suggest that men are at times overcome with faintness following excessive exertions. There is no doubt that the heart is dilated under bodily strain, but when the latter is not too great or too prolonged, or too often repeated in a given time, it quickly recovers its elasticity. With increase of years, this power of recovery deteriorates and this should be definitely recognized in all such workers.

But the final appeal as to the length of such spells is the testimony of the individuals subjected to them. At present, unfortunately, it is difficult to get such testimony from the persons concerned, because they for the most part are unused to describing their sensations or of analysing or estimating their relative importance. The investigator, likewise, is, as a rule, at the considerable disadvantage of having no practical acquaintance with the employment, and is thus unfamiliar with its special difficulties. It is interesting in this connexion to note that Miss May Smith, the investigator allotted to the laundry industry by the Industrial Fatigue Research Board, took an early opportunity of "gaining first-hand experience by working personally in a laundry for a few weeks" (First Annual Report, p. 18). Speaking from personal experience, I can testify that when engaged, as a lad of 15, for several weeks in a holiday period, at the somewhat strenuous task of pressing Glasgow bricks (about 10 lb. weight), I managed the

6 a.m. to 9 a.m. and the 3 p.m. to 6 p.m. spells all right, but the 10 a.m. to 2 p.m. spell I found too long, and from 1 p.m. on felt wishful to stop. The work was done by the piece, by a gang of three, one of whom worked the hand-press and the other two placed the bricks and carried. The pace was steady, with changing of tasks and occasional pauses when called for. I still vividly remember the sinking feeling which came on after 1 p.m. daily. But, it will be objected, and rightly too, that the experience was short-lived, and in the language of the Second Annual Report of the Industrial Fatigue Research Board, p. 7:

"Any considerable change attendant on labour conditions is followed by a period of readjustment which continues for a long time before constancy and equilibrium become re-established. It is therefore only with quite special caution and circumspection that inferences can be drawn from results obtained during such a period, although they may very probably be of special value for collation with normal results obtained later on."

A later experience of six months' duration in recruiting and national service boards has convinced me that when there is steady pressure of work with little or no intermission, spells of two and a half to three hours should be a maximum. In this as in some forms of industry there is a steady alertness of attention, combined with a moderate output of muscular energy. The "other conditions of employment" were probably often similar to that of a dusty employment, and no doubt conduced to the fatigue of attention that supervened in the third hour.

With regard to the morning period of 7 a.m. to 9 a.m. I adduce the following points. Collis and Greenwood (*The Health of the Industrial Worker*, p. 25) quote Dr. Edward Smith as writing in 1861:

"In our opinion no laborious occupation should be followed in this climate before 7 a.m., and it ought in all instances to be preceded by the breakfast. . . . The period of the day in which the human system is the most vigorous and fitted for labour in our climate is from about 8 or 9 a.m. until about 4 or 5 p.m., but it is sufficiently vigorous for a longer period."

Again:

"Rest is a necessary alternative to labour, and as small meals are conducive to muscular exertion, it is worthy of consideration if those who are engaged in manual labour for many hours would not perform it with more ease if there were more frequent but shorter intervals for rest and for meals, instead of the three meals a day at long intervals with the single long interval of rest between 8 p.m. and 6 a.m. It is very probable that more work would be done, and at less cost to the workman."

Now of these two statements, the first seems against the scheme suggested, and the second in its favour. But the opposition is only apparent. The important points are to have more frequent intervals for rest and meals, and to have breakfast before starting work. To take the last point first, it is a thing not easily to be attained by nine-tenths of the labouring classes under present conditions. And why? Because, so long as work begins before 9 or 10 a.m. there will be two factors to contend with—want of appetite for a reasonable sized meal, and the household preparation of the same. Whether it is late hours or late feeding, or unhygienic sleeping conditions, or fatigue or exhaustion, or insufficient or improper diet, or climatic conditions, or late rising, or any combination of these, there is a widely prevalent inability to take breakfast immediately on rising, and more especially among women. Even in children mothers commonly state that the child takes little or nothing before going to school. For children and adults the advice is similar: if starting work at 8 a.m., and no travel time required beyond a few minutes, get up at 7 a.m. at latest, and if possible have your meal cooked for you and set for 7.30 a.m. But this introduces the problem of the mother, who in general is the home comfort provider, and would have to rise at 6.30 a.m. Then there are the unmarried men and women, and widows, many of whom have to provide for themselves. On the other hand, with the suggested programme, the person can take a light repast before going out to start work at 7 a.m., and come back for a prepared breakfast at 9 a.m., or have it at the works' canteen.

But this advice runs counter to many presently established customs, chief of which is the lateness of city hours. That is why I prefer the 5 p.m. stoppage of work in the scheme, in the hope that the various recreative outlets for the young person and adult may have the chance of an earlier start, and so release their devotees to get to bed by 10 p.m. as in former days. This would be the true daylight saving, and not the spurious article, which is detrimental to the young and old in the cities.

Before leaving this point I give two real experiences. The first is personal. When in the R.A.M.C. (for a period, January to April, 1916) I was in medical charge of a Reserve Infantry Brigade. The plan of duties was: Sick parade, 7 a.m. to 9 a.m.; inspection and vaccination of arrivals, 10 a.m. to 1 p.m.; inspection of drafts, inoculation for typhoid, etc., 2 p.m. to 4.30 p.m. I only claim that the duties were constant from the start; later they became more so. I got up at 6.15 a.m., dressed, and walked almost a mile to the medical hut. There was an offer (which I refused on account of its unpalatableness) of a morning cup of tea. I breakfasted at 9 a.m., lunched at 1 p.m., had afternoon tea at 4.30 p.m., and dinner at 7.30 p.m. Now the point I wish to make is that, contrary to my expectation, I felt quite well for practically the whole of the time, at all the sessions, the early one included. I still believe that a pleasant morning drink would probably have been of value. Over the whole period I only missed one morning, and then it was due to a cold. It is true that the experiment was limited in duration, but it was also abrupt in its onset from a 9 o'clock start, preceded by breakfast.

The second experience is one which was elicited in the course of a visitation for other purposes. The patient was attended by the sharer of her single apartment, a Mrs. M. McB., aged 69 years. Something the latter said attracted my attention, and I soon found myself in the act of cross-examining her on the life of a weaver. I specially avoided leading questions and cautioned her against answering unless she had a definite opinion on the subject. I found that she readily understood my position, and the following summary represents her own views on the various points dealt with.

Mrs. M. McB. started work at 14 in a warehouse, but was advised by a doctor to change to weaving on account of her "chest." About 15 years of age she started as a learner in a weaving factory, making muslins and blue cloth. The hours of labour were: 6 a.m. to 9 a.m., 10 a.m. to 2 p.m., and 3 p.m. to 6 p.m. About eight years later she was married, and kept her home for the next sixteen years. She had five children. Her husband died at this time, and as the parish only allowed a shilling a head a week for the children who were not of working age, and nothing for herself, she went back to the "mill" two days after his burial. (He had been ill and off work for a long time previously.) She continued up till 1919, always at the same hours, except from 1917 to 1919 (two years), when the hours were: 8 a.m. to 12.30 p.m. and 1.30 to 6 p.m. During these two years she was weaving khaki cloth. Her wages latterly were 14s. weekly but after the bonus 23s. She preferred the hours starting at 8 a.m. for the later start. She was always a late bedder, sitting up to 12 midnight, and liked to read at night. With these longer spells she managed the first all right (except below *re* food) but in the afternoon about 4 p.m. she got tired and sleepy and for half an hour had a fight to keep alert (she would be about 65 years at this time), but this feeling would then pass and for the rest of the time she was "at herself" again. In spite of the later start she could not take a proper breakfast. Owing to the long spell from 8 a.m. to 12.30 p.m. she found she could not exist until the end of it without some food; but no break was allowed, so she bought about half a pint of milk in a can, and sipped it at intervals. Sometimes she had a biscuit. Her whole diet at this time was something like this:

Breakfast, 7.30 a.m.: Cup of tea and half slice of bread with or without egg.
Forenoon, 10 a.m.: Half pint of milk and biscuit.
Dinner, 12.30 p.m.: One slice of bread or a scone and tea, and cheese.
Tea, 6.30 p.m.: Porridge and milk, bread, and tea.

Asked if she had anything to say in favour of the old hours she volunteered the statement that after the morning spell (6 to 9 a.m.) her appetite for breakfast was better. She had no specially vivid recollections of the other spells, except that there was often a wish that it was stopping time. The early morning rush to work, however, she spoke of with great feeling: how she often left the house and her children about 5.30 a.m., with little or no food, hurrying along the streets for a mile and three-quarters to the weaving factory. Many times she arrived there in an exhausted state, and for the first half-hour of work was quivering and unbalanced and with imperfect vision. On other mornings, behind time, she saw the gate shut as she drew near; she was "quartered"—that is, had to wait outside the gate until 6.15 or 6.30 as the case might be—and had 1d. deducted from her wages; if later than 6.30 a.m., then the next time of entrance was after breakfast, or 10 a.m., with a deduction of 3d.

This unvarnished tale points its own moral. One would like to see this morning spell abolished altogether, and so have the manual worker placed on the same plane as the office or bureau worker. That would mean a six or seven hours day. There are no doubt some forms of industry in which it could be done "having regard to industrial efficiency." From the point of view of "the preservation of health among the workers," who that has seen the nation's manhood as it presented itself for recruitment from foundry and factory can doubt that those young-old men of 40 to 50 years owed their premature ageing largely to the stress of long-continued toil from the earliest years?

Further inquiries have but served to confirm the main points evoked in the above recital. There are still some who would prefer a return to the old long hours, from various reasons. But the majority prefer the later hour of starting (generally 8 a.m.), while admitting that they could not carry on but for a "piece" or cup of tea about 10 a.m. One worker liked the old hours worked (ten a day) as being less anxious then about her output. There had been no speeding-up of the machinery, so the inference seemed to be that she was missing the "rests" which she could afford on the longer spell.

Another objection to the 7 to 9 spell is that it increases the stoppages and starts, and working time is always lost then. Thus before breakfast and dinner, those who do not go home for meals begin to prepare their tea, etc. Those who go home, on the other hand, work on. It seems unnecessary to point out that if any favours are going, the workers who have to leave the factory and travel home and back again should get them, and that the stay-ins have all the time to prepare and take their food.

The main objection to the three-period day with two breaks will come from those who believe that after every start there is a "warming-up" time required, and that the repetition of this results in serious loss of working time. This is still a matter for further investigation. Different workers show different habits, but there is no doubt that, in the mass, the start is gradual at the first period. After that the observations are too variable to make a definite statement. In any case it seems to me that this is an individual characteristic which is likely to show itself in another form when we try to evade it. As long ago as 1884, Mosso, when studying ergographic tracings of muscular contraction, found that (*Fatigue*, Drummond's translation, 1915, p. 90 et seq.):

"The profile of the curve, that is the line which is obtained by uniting the summits of the contractions, forms a curve which varies in different people. I have been unable to find a reason for this fact, and have ended by convincing myself that it is in truth a *constant* feature which indicates the diversity which every one presents, *in his way of becoming fatigued*. . . . Some suddenly feel tired and give up work, while others, more persevering, gradually expend their energy until by degrees complete exhaustion supervenes."

Now, it may be objected that there is not much real fatigue, in Mosso's sense, in these times and in many forms of industry. Whether that is so or not, there can be no doubt that the repetition of muscular acts, however simple, unless followed at appropriate intervals by a period for recuperation, will produce that fatigue which shows itself "in a diminished capacity for work." In the heart muscle we have the great example of unceasing action, but on analysis this proves to be a perpetual alternation of a period of effort immediately succeeded by a pause period, twice as long in point of time. We must choose therefore one of two conclusions:

1. The worker must be permitted to work in an unsystematic manner, working and resting as the natural feelings dictate; or,
2. We must provide spells of work with definite rest pauses, and these must bear a relation to each other, which will vary with the other conditions of the work.

The first solution is the one adopted by the old-time home worker, and is a well-known one among intellectual workers, who are prone to overwork when the mood is on, and then have to lie fallow until reinvigorated. This method, however, did not fuse well with the introduction of power-driven machinery and factories, and has practically disappeared except in the smaller country districts, where the home worker can arrange his day's programme as his wishes dictate.

The second conclusion is therefore the only one left, and the object of this discussion is to elucidate the various parts of it.

B. *Other Conditions of Employment.*

The other conditions of employment are undoubtedly influential in the onset of fatigue, in industrial efficiency, and in the preservation of health among the workers. Many of them are not so subtle of solution as the problem we have just been studying, and their improvement is largely a matter of ways and means. Such are good buildings, furnishings, lighting, heating, and ventilation. For most factories the application of the well-known principles of hygiene are sufficient. In a few, special difficulties arise: heat and moisture in cotton-spinning; excessive heating in glass-blowers and iron and steel workers; dusts and poisonous gases and liquids; and poor lighting in mines. Even here much can be done by willing co-operation on the part of master and man, although, unhappily, lack of this still exists. Professor Gilman Thompson, of Cornell University, New York, writing in 1914 (*The Occupational Diseases*, p. 77), divides employers of men in hazardous trades into three classes:

(*a*) Those willing and sometimes eager to co-operate in the betterment of their working conditions.

(*b*) Those who have already adopted all practical means of avoiding disease hazards for their workmen.

(*c*) Those who assert, through indifference or ignorance, that such alleged evils as industrial diseases do not exist, at least in so far as their own establishments are concerned, or that, if they do, they are solely due to the workman's own negligence.

Our latest authoritative writers on *The Health of the Industrial Worker* (Collis and Greenwood), 1921 (p. 40), make the following remarkable statement:

"Looked at from another point of view, the student of the human machine and of its requirements to maintain health and efficiency is astonished, first, to note how the reasonable recommendations of important committees and Royal Commissions are passed by unheeded, while attention is paid to subjects pressed to the front by the uneducated voice of labour, or required in the interests of production. . . . Next, legislation is observed seldom, if ever, to lead reform, but to follow in the wake of progress, adopting the procedure of the more advanced employers of the time."

Let us leave it at that. Progress is slow. We still need a Carlyle to thunder out that "Supply and demand is not the one Law of Nature: Cash-payment is not the sole nexus of man with man" (*Past and Present:* The Modern Worker, chapter ix).

C. *Methods of Work.*

Under this heading is included such things as (1) the organization of the workshop or factory for the task in hand; (2) the adjustments of the worker and the machinery to each other; and (3) the different movements in each worker's task. All these are highly important in abolishing waste of energy on the larger as well as on the smaller scale. So much is this the case that in large factories with a standardized output the production can be enormously increased, thus allowing for reduction of hours with increase of pay. Although this highly desirable result cannot be generally obtained, valuable amelioration of working conditions have already been effected and more is in prospect. The training of the worker in the most approved manner of performing any set of motions which are in repeated use at the employment is now admitted to be of economic as well as of physiological value. But here as elsewhere caution must be exercised. The adjective "clumsy" is often used to stigmatize efforts which are markedly awkward or ungainly; the danger lies in using it for some set of motions which are unusual, and different from the "herd" method. The writer has been informed of a girl in a toy factory, who came from a mentally defective class, and whose mode of working attracted attention by its being different from the common one. On close study it was seen to be an improved method, and when all the girls were taught it the output was definitely increased.

Workers engaged in complicated co-ordinations and when speeding-up on piece-work sometimes adopt swaying or rhythmic movements of the trunk to accompany the movements of the hands and arms. This is seen notably in making chocolate biscuits, where the worker sitting at a table takes a biscuit with the left hand, places it under a shaped opening, through which

it receives a layer of chocolate cream, smeared over it from a spoon held in the right hand. She then removes the biscuit, inverts it over another biscuit which adheres to it, and places the completed article on a tray (all with the left hand), and immediately starts the process afresh. The whole action is not unlike the problem of touching the top of one's head at regular intervals with the right hand while the left goes through a series of performances unrelated to this act and requiring a greater expenditure of nervous energy. An imbalance is produced with increased excitability. Relief to one's feelings is got by dispersing the pent-up energy in other movements, which in this case is often a circumduction of the trunk on the hips, producing an effect not unlike that of the "belly-dance" of some savage tribes. This added movement is closely related to the lip and tongue movements seen in children learning to write, due to the excess of energy put into the task, some of which overflows into adjoining motor centres. To see such a girl at work suggests the possibility of untoward results from undue speeding-up, most likely to take the form of "neurasthenia," or being "run down" as the workers themselves would phrase it. The body motion itself, when excessive, might likewise originate other symptoms, allied to those attributed to the old treadle sewing machine. Perhaps some of our welfare workers may have had voluntary evidence on this point; it is not one on which suggestive or leading inquiries are admissible when dealing with young persons.

In this connexion—namely, employments in which there is a considerable attention required while the muscular effort is not in the usually accompanying proportion—it is interesting to note that shirt machinists in factories are in the habit of singing in unison at their work; and that employers state that they like to hear this occur, because the output of work is usually good under such conditions. There is still room for much investigation to be done under this heading, more especially to set the upper limits to "speeding-up" and if possible to devise some test or tests to determine this for each worker, for the individual variations are a source of much industrial difficulty. If the output is rated too high, the worker is sweated to make a living wage; if too low, the master may go to the wall.

Vocational Selection on a Basis of Physical Inquiry.

In the middle and working classes the choice of a vocation is conditioned by one's environment for the most part, and in a secondary way by chance. A worker hears of a vacancy in some factory for a boy or girl and reports the matter to friends who have young people about to leave school. Application is made for the post, and the foreman or manager selects or rejects the candidate according to various points which his experience has taught him. But the influence of the person recommending may cause engagement to take place in spite of obvious defects or other better material offering. The whole process is more or less haphazard. Nevertheless, it preserves the individual's freedom of choice, however little it may be exercised. It is now proposed to select the worker for the vocation on the basis of intelligence and physical tests, although in the first instance they are only to be advised "as to the occupations for which they are naturally fitted." Very great caution and circumspection will have to be exercised in this matter, the adviser bearing constantly in mind his own severe limitations of knowledge of the different aptitudes required; and moreover that a child who may fail to shine in his test scheme may nevertheless display peculiar adaptability to a branch of manufacture. The case quoted above of the child classed as mentally defective illustrates this, although one has to remember that at present such classifications are not universally reliable.

While this is so there are certain defects which are such as to demand that the individual's freedom of choice should be curtailed, in his own and the employer's and the public interest. We are here limited to the physical side. Certain broad generalizations can be laid down: the stronger and more robust should be advised to the more arduous and trying occupations; those subject to bronchial conditions should have indoor non-dusty jobs; while those with heart affections would be advised to the clerical or such-like tasks. Children of small size might still be of service in work done in the sitting posture, as the sitting height is usually good, the shortness being commonly in the legs. In this connexion it must be remembered that such children often grow considerably for the first year or two after starting work, whether from improved feeding or other causes. Then children with serious defects of sight should be excluded from all work with moving machinery. Squint or strabismus is associated with defective sight in the squinting eye, up to practical blindness. All such cases should be carefully examined and their position definitely defined. Want of cleanliness of the head and body should be an absolute bar to all work connected with foodstuffs. It is not sufficient here that the children should be examined within a week after starting work. To have an odd child with scabies engaged in the manufacture of chocolates is bad enough, but some young persons, very dirty as to head and body, but with a surface cleanliness, are so engaged. An inspection should take place prior to engagement, and can be most efficiently done by the welfare master or mistress.

Special problems arise, such as persons with perspiring hands, with odoriferous bodies and feet, and so on. These must be settled on their merits. They will not arise as a rule in open-air jobs, but where work is carried on in enclosed spaces with increasing temperature and poor or no ventilation.

It may be said that these precautions are obvious ones. No doubt that is so to the trained observer, but we must remember that the engaging of young persons is still practically anybody's job, and that experience gained is lost to the firm when the person gaining it is promoted to another task where this is not one of his duties.

Summary.

Hours of labour: Spells of work to be normally two to three hours in all occupations demanding steady application and attention. In arduous work there must be rest spells after excessive exertions, and the latter must not be unduly prolonged.

Definite intervals for meals must be provided. For work starting before 9 a.m. two meal periods should be interposed in the time-table, owing to the fact that few persons take a normal amount of food in the morning, and it is too long to work a three or four hours spell before again getting food.

For the eight-hour day a three-spell day is therefore recommended, the first of two hours and two of three hours each. For a nine-hour day the first spell may be two and a half hours and the others three and a quarter hours each. If an industry can give a "living wage" on shorter hours this should be done, and the morning spell abolished.

Conditions of employment, especially in hazardous occupations, should be good. If such conditions cannot be secured, the industry should be suppressed.

Methods of work are worthy of study, to eliminate waste of energy, to find "best" methods, and to avoid harmful movements.

Vocational selection is at present limited to the "don'ts" department. Young persons with certain defects should not be permitted to engage in specified employments.

ADDENDUM.—Since the information in this paper was published, and as a consequence thereof, much additional information has been conveyed to me in regard to food difficulties in connexion with the morning start at 7.30 or 8 a.m. and working without a break for four, four and a half, or four and three-quarter hours. In some cases the breakfast, of whatever kind, is partaken of one hour to one and a half hours before the starting time. In an engineering works, after three years of the 8 a.m. start, numbers of the men have discovered for themselves the value of rising at 6 a.m. and leisurely making their old breakfast of porridge and milk which their wives formerly made for them at 9 a.m. This fact is a valuable confirmation of the advice given in the paper; for though tendered to many mothers during the past dozen years none have reported its adoption or the result. (D. McK.)

DISCUSSION.

Professor E. L. COLLIS (Cardiff) described fatigue as a negative term and activity as the real subject of inquiry. Maximum activity and maximum health went hand in hand. The end and object of the doctor and the employer were really identical. Hours of labour must be distributed so as to produce maximum activity or output; health would follow. Study of industrial output showed that, as in athletics, the record-holder proceeded at a steady even pace and not by fits and starts. Schemes for hours of work must stimulate an even pace. Vocational selection to-day should be more confined to physical and physiological characters and less to the newer science of psychology. Not until the former were exhausted should psychology be appealed to.

Dr. W. F. Dearden (M.O.H. Port of Manchester) referred to the statement that workpeople did not get to bed sufficiently early to get the necessary night's rest, and was of opinion that this must be due to local conditions more than to daylight saving. He had himself noticed the late hours kept by Glasgow people, the streets being quite alive with promenaders at 11 p.m., and these had not all disappeared at midnight. This was quite different from what obtained in Manchester and other Lancashire towns, which in the evening had more the appearance of dead cities. The last remnants of the inhabitants were on their way home at 10.30 p.m., and were at home if not in bed at 11 p.m.

Dr. McKail, in reply, thanked Professor Collis and Dr. Dearden for their illuminating and kindly criticism. The suggestion thrown out by the former, that it was the steady pace that paid, was a valuable one. As to the lateness of the hour for retirement in Glasgow as compared with Manchester and other Lancashire towns, perhaps Glasgow's late car service had a deal to do with it. Late hours were certainly detrimental.

THE CONSTITUENTS OF FRESH AND VITIATED AIR AND THEIR SIGNIFICANCE IN PROBLEMS OF VENTILATION.

BY

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[*Abstract.*]

In view of the benefit derived from exposure to fresh air in the open as contrasted with the air of occupied rooms, it has appeared useful to investigate the value of the so-called "active oxygen." To this end a series of oxidation experiments have been devised. Cubes of phosphorus of equal surface area and equal freshness were prepared and were exposed in specially designed flasks for half an hour to atmospheres of fresh and expired air respectively, the amount of the resulting oxidation being measured in terms of phosphoric acid. Under such experimental conditions it was found that oxidation in fresh air exceeded oxidation in expired air in the proportion roughly of about 4 to 1 instead of in the proportion of 4 to 3, as might have been expected from contrasting the oxygen content of the two air samples.

The interpretation of such results is difficult. It is at once obvious that the law of mass action is not applicable to action at a surface, surface being concerned in this case and not volume. Moreover, allowance must be made for migration or diffusion of the reacting substance in the oxygen content of air towards the surface. Finally, the oxidation of phosphorus is known to present certain physical anomalies that make it impossible to arrive at a definite conclusion from the oxidation results obtained. Experiments with several other rapidly oxidizable substances failed to give proof of the presence of an especial "active oxygen" content in fresh air. It may be of interest to note that the phosphorus cubes first used in these experiments were graded and polished by file under water. It was found, however, that comparable discs of equal surface area were best prepared by moulding under hot water. It is only right that I should acknowledge here the assistance I have received from Dr. Brownlee, statistician to the Medical Research Council; he designed the initial experiments here described.

It is evident from previous experiments of other workers that the ill effects resulting from a vitiated atmosphere are not due to a diminution of oxygen or to an increase of carbon dioxide. As regards impurities in the atmosphere, the general consensus of opinion based upon the evidence presented excludes such poisonous bodies in expired breath as a factor explaining the malign effects of vitiated air. All the experiments devised to demonstrate such an effect have failed apart from the demonstration of sensitization to proteins. It is concluded, therefore, that the ill effects produced by vitiated air are due to physical changes only. The work of Leonard Hill and others makes it obvious that the vital element in ventilation problems consists in regulating the temperature, moisture, and motion of the air.

Chemical analysis having failed to demonstrate the cause of the "deadness" or want of freshness in air, and the effort to demonstrate clearly an "active oxygen" content of fresh air by means of oxidation experiments having been indefinite, it appeared that it might be of advantage to test further the physical changes in vitiated air. In this connexion it was evident that, while the presence of radio-active substances in the air had been demonstrated by Elster and Geital, and that it was known generally that air and soil and certain mineral springs contained certain radio-active substances, nevertheless the accurate measurement of the radio-active changes in the air had not been accomplished, nor had any effort been directed towards determining the possible effect of such radio-active changes on biological activity. In view of the otherwise extensive and intensive investigation of the physical components of air and their effect on human well-being, the investigation of the radio-active properties of air appeared to be urgently desired.

An apparatus was put at my disposal by Professor Soddy of Oxford University in the form of an experimental electroscope of one of the types used for radio-active measurements. With such an apparatus two points may first be demonstrated—namely, (1) air washed through water in a wash bottle before being passed through the experimental air tube of the electroscope is deprived of its ions, as a result of which the electroscopic leak is diminished; and (2) air passed through a rubber tube before being admitted to the experimental air tube is similarly deprived of its ions. It is obvious, therefore, that the modern system of artificial ventilation, wherein air is washed by passing through a water screen and thereafter conducted through a series of ducts, must deprive the air of whatever ionic content it initially had. Moreover, it is further demonstrated by this experimental electroscope that expired air is destitute of ions as judged by the delayed discharge of the electroscope. It is evident, therefore, that should the ionic content of air have any benignant effect on human well-being its treatment in any modern system of artificial ventilation serves but to deprive it completely of such energy content.

It has been found that the passing of a continual stream of expired air through the tube of the experimental electroscope results in the production of a negative radio-active effect. Thus a continual stream of expired air, instead of causing a slowing of the discharge of the electroscope, a result to be expected on account of its lack of ion content, although such slowing might have been compensated for by the increased leak due to the influence of condensation water that rapidly covers the under surface of the insulation of the electroscope, causes a complete arrest of electroscopic leak and results in a cessation of the leak for the period of a quarter of an hour, the duration of the experiment. This result, amounting to an increased charge on the electroscope, has been continually experienced when a current of expired air has been passed through the tube of the electroscope. The existence, however, of such a thing as negative radio-activity is according to modern theory an impossibility, and the effects observed in the electroscope were attributed to instrumental or other experimental error.

In order to test for such experimental error, the following points were determined:

1. Any possibility of the result obtained being due to the nature of the original electrical charge on the electroscope was negatived by finding that the same effect always occurred, whether the charge was negative or positive.

2. Any possibility of an induced electrical charge due to the passage of the air current being the cause was negatived by earthing the tube of the electroscope.

3. Any possibility of the so-called apparent charge on the electroscope being due to any thermal currents was negatived by (*a*) first boxing the apparatus so that the contiguity of the experimenter should be obviated as a cause, and (*b*) by enclosing the entire apparatus in an incubator constantly maintained at a temperature of 37° C.; it was found that no alteration in the results occurred under both these conditions, the apparatus continuing to record an increased charge so long as a current of expired air was passed through it, and no matter whether the electroscope had originally received a negative or positive charge.

4. Finally, it might be suggested that the increased charge shown on the leaf of the electroscope when expired air is passed directly through the tube is to be explained by the assumption that there is a diminution of the dielectric capacity of expired air as compared with fresh air. This is negatived, however, when it is recognized that the alteration in charge should appear whenever the air of the tube is replaced by expired air—namely, at the end of the first expiration. This is not the case. Moreover, the variation of dielectric capacity in gases such as oxygen, nitrogen, and carbon dioxide is so small, 0.000+°, that it is clearly altogether unlikely that decreased dielectric capacity of expired air is the cause of the phenomenon observed.

In connexion with the observations on my part, which are entirely independent of the work of other observers, as to the effect which expired air has on retarding the rate of discharge of the electroscope, the findings of electroscopic

retardation by two other observers are of interest. Thus Lazarus-Barlow has announced similar findings in connexion with the examination of carcinomatous and non-carcinomatous tissues. Similarly Buchner communicated on the same day to the Royal Society a paper on a mineral which retards the rate of discharge of an electroscope. I am convinced that, similar findings having been described by three independent workers, renewed observation is urgently required. Intensive investigation of all the principles concerned in the differences between fresh and vitiated air have until now failed, and, it being the general consensus of opinion that the so-called fresh air of any artificial system of ventilation is dead, it is my opinion that the ionic differences, both physical and physiological, between fresh and vitiated air should be further investigated.

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THE WRONG TURNING IN PUBLIC HEALTH.

BY

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THE administration of public health in its beginnings, and indeed up to quite recent times, was essentially what it was often called —"preventive medicine." That term has almost dropped out of use, and the "wrong turning" I allude to in my title is the tendency for the ideals of prevention to be obscured in our solicitude for the treatment of individuals already diseased.

Communal disease is the last term in a faulty social metabolism; to alleviate or cure it in the individual is the function of the physician and the surgeon. To seek its origin, to discover where the social metabolism goes wrong, to direct our social evolution along the channels that make for health in the community, is the function of government, both national and municipal.

The principal cause of communal disease is poverty, and poverty is increased by waste. It is admitted that excessive taxation, both national and local, is one of the causes that is preventing trade recovery, and is thus both directly and indirectly increasing and maintaining poverty; and with poverty, public ill health. Every penny spent on public health administrations, as on education or any other object admirable in itself, is as much waste, if it cannot be justified by results, as if it were spent on any other form of extravagance. When Government or municipal organizations begin to deal with individuals the tendency to waste is enormously multiplied, for public funds can never deal with the whole of the individuals suffering from disease. We shall always be attacking our problems on mere fragments of the periphery, and as can already be seen the cost of this kind of skirmishing is so excessive that in these days funds must be diverted from what should be the main attack on disease at its source and origin.

This modern tendency is all to the credit of our consciences, of the emotional side of our natures. In spite of the callous delight in murder, the recrudescence of the belief in violence and destruction as a means to political ends which has disgraced the post-war period of our history, there was perhaps never so much pity for suffering, never so many consciences awake to the rights of helpless people, "of women labouring with child and young children," of the maimed and crippled and diseased, as there are in this distracted generation. Industry is no longer allowed to grind wealth out of needlessly inflicted suffering, even soldiers are cared for, and possibly merchant seamen will one day be treated as human beings when the public learns how they are treated even now. It is not very long since torture was regarded as a therapeutic measure for lunatics. Now if we hear of an asylum attendant losing his temper with a patient it is regarded as a national scandal and a Royal Commission is demanded. All these are but instances of what even the pessimist must regard as a genuine evolution proceeding in social morality. If it does lead to the formation of endless committees and innumerable so-called "national councils" for doing the same thing under slightly different names, the majority of these organizations are quite harmless, and if they waste money it is largely money which would otherwise have been wasted on something else.

We have thus in the promotion of public health a greater backing of enthusiasm than probably our predecessors ever knew. But enthusiasm to be effective must be guided by expert criticism, and I think it is the duty of public health administrators to resist the temptation to yield to popular clamour in favour of purely eleemosynary schemes, or methods of advertisement, which tend to divert public funds from the prevention of disease to tinkering with disease when it has developed.

It is to me humiliating that the sole check on public health administration should be financial control. And of this we have recently had unpleasant though fully justified examples. The value of human health, if reckoned only in terms of money, is so immense that public opinion would not long tolerate a refusal to finance any proposal which would certainly result in a lessening of disease or an increase in the expectation of life. Unfortunately at present money is most lavishly spent in the very directions where it is least possible to demonstrate the value of the results.

The difference between these two theories of public health progress has been admirably put by Sir George Newman with his invariable instinct for the just word. Speaking to a post-graduate class for school medical officers recently, he said: "The centre of gravity of public work must swing more and more from the environment to the individual." It is just this deflection of the centre of gravity of our activities that I think we should view with a certain amount of distrust, especially in these days when expenditure in new directions necessarily involves curtailment of other functions.

The principal developments in public health administration of late years have been the National Insurance Act, with its provisions for the treatment of sickness generally, and in especial of tuberculosis; the medical inspection and treatment of school children; the great development of maternity and child welfare work; and lastly, the free treatment of venereal diseases.

The whole of this work, all most laudable in intention, is directed to the individual. Its cost has been almost incalculable, yet when it was found necessary to tackle the impossible environmental conditions into which our population had drifted at the termination of the war, the whole of our housing schemes broke down for want of money. Overcrowding and slum conditions are to-day engendering tuberculosis, drunkenness, venereal diseases, rickets, pneumonia, measles, and other diseased conditions in quantities which our breathless efforts at dealing with end-results are powerless to overtake.

On the other hand, public health administration of what I may call the old-fashioned sort aimed almost entirely at the environment. The improvements effected by it affected whole masses of the population, not selected individuals, although of course there was none of the cowardly callousness towards the individual which characterized ruder ages—as, for instance, in the treatment of lepers, where the suffering individual was deliberately and ruthlessly sacrificed in the interests of the rest of the community.

Public health in the sense in which we know it, including all factory and industrial legislation, is practically the product of the nineteenth century. The unexampled increase of population resulting from the industrial revolution; the mad rush for wealth which welcomed a teeming and half-starved population as an unlimited reservoir of cheap labour in peace and cannon fodder in war; the utter want of foresight which permitted this population to develop uncontrolled in conditions of squalor almost inconceivable to us now, had its reward in the epidemics of fever and cholera which at last terrified our rulers into passing legislation directed to the serious improvement of the environment of the people. The various measures passed during the first three quarters of the century were consolidated in the Public Health Act of 1875, which has from time to time been amended, and was quickly followed by further legislation in the Infectious Diseases Prevention Act and the Housing Acts.

Every medical officer of health knows the depressing effect, the sense of almost hopelessness, that is apt to crush him in his visits to insanitary property, the indignation that is apt to possess the twentieth-century bosom in the presence of overcrowding, dilapidation, dampness, darkness, dirt, unpaved yards, privy-middens, open ash-pits, above all the acquiescence

in squalor, the indifference to filth, the utter carelessness that makes the worst of foul conditions which is displayed by a generation that is the product of over fifty years of what we retain the habit of describing as "education."

When I am most depressed after such a tour I turn to a manuscript report in my possession on the sanitary conditions of Sheffield. This report refers to the condition of the town in 1846. I learn then what were the problems our fathers had to face.

This very ably written document gives in elaborate detail the condition of yards ankle-deep in putrefying ordure from privy-middens used by from fifteen to twenty families. In this the children played and the liquid material drained into the houses. There is one case of a privy serving nineteen families and the children attending a *school built over it*, a frequent arrangement in those days. Everywhere in the poorer parts of the town there were rotting piles of vegetable and other refuse, unremoved except by the natural processes of decay. One court is mentioned in which the whole of the inhabitants were suffering from "low fever." People were forced to live in these places

"because of the lowness of the rents. In nearly every case we found on inquiry" (say the authors) "the people resolved to remove as soon as they were able. Too often, however, that time never arrives. From constant ill health and loss of labour their circumstances are seldom improved but become worse and worse, and if death take off the main branch of the family nothing remains for the survivors but the union workhouse."

That quotation is a very complete indictment of the principle of leaving the environment alone and dealing with individuals. The water supplied to the town is described as being of good quality, but

"the supply of water in many parts of the town is not kept up for more than two hours at a time, twice or three times a week, and this being distributed to the humbler classes by means of public stand pipes, many find great difficulty in procuring a sufficient quantity for ordinary domestic purposes, much less for scouring their houses and courts. Many persons are in the habit of storing the water in wooden tubs placed before their doors, when it soon becomes foul from the deposit of soot and other foreign matters so as to be unfit for use."

The well water is described as being freely polluted by putrid material from the conditions enumerated in the first part of the report.

Ventilation of the houses was "by apertures in doors and windows," and even these had to be kept closed owing to the abominable stench from outside. Ventilation of schools, workshops, and public buildings was quite simply ignored.

It is not surprising that in 1832 Sheffield was visited by an epidemic of cholera which caused over 400 deaths in six months, and that the normal death rate of the town at the time of this report was *over 28 per 1,000*.

Such were the conditions with which early public health legislation had to cope, and no one who is familiar with the Public Health Act can fail to be impressed with the comprehensive and radical ideas of the men who framed it.

In all the legislation of that period almost the only attempt to deal with the individual was the provision of isolation hospitals for infectious disease, and that was undertaken primarily not in the interest of the patient but for the protection of the community against the spread of the disease. Even vaccination, though necessarily applied to the individual, was, in the days before sanity was ousted by sentimentality, made compulsory for the whole population.

It is interesting, therefore, to glance at the results achieved by this tremendous attack on environment and to compare them with the results so far achieved by our modern method of treating the individual.

The history of the general death rate in England and Wales during the fifty-two years 1870 to 1921 shows that the highest figure was 23, in 1870. This is almost equalled in 1875, the date of the passing of the Public Health Act, and from that time on the decline has been continuous, so that in 1921 the rate is practically only one-half that of 1870—namely, 12 per 1,000, against 23 per 1,000. If it were possible to take the figures for the great towns only, this decline would be very much more marked. But populations in the great centres have altered so much during this period that accurate comparison is very difficult. Had the death rate remained during this half-century at the 1870 figure with the progressively increasing population, the number of years of human life which would have been lost is almost incalculable. It seems to me impossible to find any factor in bringing about the change which can compare in importance with the steady pressure of public health authorities in improving environment.

The history of the decline in the death rate from some of the more important infectious diseases from 1851 to 1920—a period of seventy years—shows that at all ages the death rate from the group of diseases known as "Fever" has declined from 980 to 25 per million. This group includes the exanthemata, and in the earlier decades relapsing fever and other forms of continued fever, which were not always diagnosed with accuracy. Many of these cases were probably typhus and typhoid. It is quite likely that the group includes cases which would now be classed as influenza, pneumonia, appendicitis, and other abdominal conditions not accurately understood in those days.

Small-pox, with a sudden rise in the late sixties, has declined from 250 per million to nothing; enteric from 375 in 1870 to 25, and typhus from 75 in 1870 to nothing.

In the age groups 0 to 15, the mortality from scarlet fever has declined from 2,700 in 1865 to 25 in 1919. This is without any corresponding declension in the attack rate: it is almost entirely a lessened fatality representing a change in the type of the epidemics. The only factors we know of to account for this are environmental improvements and isolation in hospital. It seems not unlikely that as the more severe cases would be more certainly diagnosed and isolated, it was the milder strains, the missed cases, that had the opportunity of propagating a milder type of the disease.

Diphtheria has declined from 1,400 in 1865 to 500. Here, of course, an important factor has been the introduction of antitoxin, essentially an example of treatment of the individual, but the high death rate from this cause remains an unsatisfactory feature of our statistics.

Measles, for which nothing has been done directly, has hardly declined at all. The comparatively low figure of 600 in 1919 has no guarantee of permanency, and measles remains the most deadly disease of infancy; all the more dangerous because it seems impossible to teach the public that it is not a trifling disease, although even in the sixties it was claiming nearly five times as many victims as small-pox.

These are records of great achievement, and it would, of course, be unfair to expect the curve of progress to maintain the same steep angle. It is also impossible to make a just comparison between recent developments, with a record of only a few years, and the comparatively long periods we have been discussing.

In the decline in infant mortality from 1870 to the present day what I may call the individualist school of public health has its greatest triumph. Investigation shows that all the sanitary work of the last thirty years of the nineteenth century did nothing at all to protect or prolong infant life; in fact, during this period it actually reached its maximum in 1899. This is not very surprising, for the child's environment is its mother or its nurse, and to this day hygiene and mother-craft are not considered "educational subjects." The management of infants remained a matter of tradition expounded by the handy woman and her colleague the lady next door.

Doctors who seldom saw a sick baby before they were qualified absorbed their clinical teaching from the same exalted source. Convinced that Nature did not know how to make a baby that would not come unstuck after it was born, they continued to compress ribs and abdomen with flannel binders, to deprive the child of Nature's colostrum, to dose it with indigestible starch in the form of barley water; when the child got indigestion accordingly they repeated the midwives' dictum that it was "sucking wind," and acquired a reputation for practical wisdom and being a "very clever doctor." Then of course the child had to swallow drugs of one sort or another, or wherewithal could the quarterly bill be furnished forth? Then when the child was weaned, prematurely or otherwise, the only available food was the emulsion of cow-dung and house-flies known as fresh milk.

Our child welfare centres have done an immense amount to change this state of affairs. To them and their staffs, and to the unremitting toil and devotion of armies of health visitors, must, I think, be given the main credit for the fact that the

infantile mortality of England and Wales in 1921 was almost precisely half what it was in 1899.

But mere saving of child life is not enough as an end, unless we make these lives worth living; and I do not believe that life in a slum on the margin of subsistence is worth living. I think most of us, if we had to be born again as a slum child, knowing what we know now of the prospect before us, would say "an enemy hath done this thing," and desire greatly to be put to death before the weary pilgrimage began. The very fact that we are causing so many infants to survive seems to me only to emphasize the duty of providing them with an environment in which they can be happy.

The story of the death rate from pulmonary and other forms of tuberculosis from 1859 to the present shows very clearly the seldom appreciated fact that tuberculosis was a steadily decreasing disease for at least a generation before the public became excited about it. I think it is probable that the apparent reduction in mortality is to some extent neutralized by increased accuracy in diagnosis. This, however, is a factor which cannot be demonstrated, but must be assumed, so that in all probability the progressive decline is even more marked than would at first appear. There was a temporary interruption of the decline during the years 1915 to 1918, but I do not think it would be fair to attribute this increase entirely to the introduction of sanatorium benefit. War conditions and pensions claims increased both incidence and notification, and a change in public opinion had removed the desire for concealment of the true cause of death. Phthisis, in fact, became much more remunerative as a cause of disablement than chronic bronchitis or emphysema. At the same time I have no doubt, having personally witnessed its effect, that the system of three months' treatment in a hospital or sanatorium of infective cases, by slightly prolonging the lives of the sufferers, increased their opportunity of disseminating the disease when returned to "domiciliary treatment," and that this tendency was not neutralized by any training or discipline which was inculcated in the hospital. The whole of our tuberculosis administration is in fact a classic example of the ill effects of neglecting environment in favour of dealing with the individual. Well-intentioned but untrained people awoke to the fact that very large numbers were dying of tuberculosis, and about the same time open-air treatment and sanatoriums were boomed as a method of cure. There was an outbreak of "national societies" through which influential members of society demanded the immediate provision of sanatoriums for all, and this to a great extent was done at an enormous cost in the days when there was "money to burn."

The thing must be done on a "national" scale; there was to be no waiting for the result of experiment on a smaller scale, and the still small voice of criticism and warning was ignored. But the warning voice was there. Many who had long experience of tuberculosis were sceptical, and as long ago as 1910, when the Insurance Bill was still under discussion, Messrs. Elderton and Paten had published the third series of their *Study of the Statistics of the Mortality of the Tuberculous and Sanatorium Treatment*, under the auspices of the Department of Applied Mathematics of London University. Their conclusions were as follows:

1. The mortality of tuberculous patients who are undergoing or have undergone treatment is much heavier than that of the general population, and even when the disease is taken in an incipient stage the mortality is about four times as heavy.

2. The mortality of the apparently cured cases is about twice as heavy as that of the general population.

3. The mortality among sanatorium patients does not show any improvement on that of Williams and Pollock's cases—that is, cases treated in pre-sanatorium days.

These conclusions are fully borne out by the more recent statistics of Dr. Bardswell and others, and I think it is now commonly held that the most hopeful function of the sanatorium is the isolation of infective cases. Yet we have been landed in the position of spending some millions a year on the treatment of tuberculosis, while there is no money available for the elimination of the insanitary areas where we cultivate more tuberculosis in a week than all the sanatoriums could house in a year.

This is largely due to the eleemosynary idea, admirable in itself, but cruel in its results. In my experience hard heads contain more real kindness than soft hearts. Improved sanitation has helped the natural tendency to the elimination of tuberculosis which statistics prove to be in operation. The only practical sanatorium for the people is a reasonably healthy environment in their own homes. It is on the people themselves that the cost of all this business eventually, if indirectly, falls, and by increasing poverty we are creating more disease than we relieve.

I must now refer briefly to that very important branch of modern public health work—the school medical service. Here again I speak from an experience of over ten years as a school medical officer, and I am satisfied that as a result of the work of the school medical service a very large number of individuals has been benefited. We have only to read through Sir George Newman's most valuable reports to realize the vast scale on which the work is now organized, a development of which some measure may be found in the fact that the cost of the service has increased from £325,735 in 1913 to £885,625 in 1920.

Even the latter figure would be by no means excessive if it were producing a harvest of health, if it were being spent in directions which could be relied on to produce successive crops of school children with a declining sickness rate, so that the cost of discovering and treating ailments would be a steadily diminishing amount. But among all the tables published in these annual reports I can find none that shows a comparison between the percentage of children found to be suffering from some form of defect in each of the years since school medical inspection has been in force. The materials for such a table must be available, but there is no reason to suppose that it would show any decline. The number of cases of disease treated in one generation of school children will not lessen the number of defects in the next.

The best test of the educational success of the school medical service is probably the promotion of personal cleanliness and the reduction of verminous conditions. In the ten years' retrospect included in his 1917 report Sir George Newman claims that ten years' work has "revolutionized this matter," and in support of this statement he is able to quote some very remarkable achievements in London, Torquay, and Carlisle. But the comparison is not given for the whole country. In the districts with which I have been familiar, while there has been some improvement it has been much less marked. And the improvement has been something imposed upon the parents by the authority, not emanating from themselves, and therefore not indicating an advance in civilization.

The diagnosis of vermin is still met by parents as an insult, and denied even in the face of the demonstration of lice actively parading the scalp. I was once assured that the child could only have obtained these companions from myself. It is scarcely surprising that we are still confronted by the parent who admits the presence of "nits" but assures us that there is "nothing living," since this extraordinary distinction is apparently official and is retained in the annual reports. What would we think of a sanitary inspector who reported "eggs" as being present on one farm and "eggs and hens" on another? Personally I should consider that his powers of observation did not justify his retention on my staff.

At the date of this report Sir George was evidently deeply impressed with the importance of environment. He says:

"Here is an unclean child to be cleansed by the authority, but it returns to a verminous home. Here is a child provided with spectacles, but it continues to be taught to read small type in a badly lighted classroom. Here is a scheme for providing school meals, but the arrangement bears no relation to the food supply of the home of the child or the social condition in which the child lives."

Again he says:

"It is well to cure ringworm, remove adenoids, and correct defective vision; but it is still more important by unity of effort and co-ordination of agency to secure the essentials of health for the whole body of the six million children in the State schools."

Yet in 1920 he tells us, "The school medical service finds its fulfilment only in the service it can render to the individual child."

It is only a few months ago that I had to protest in vain against the continued use of a school where the only playground for boys was an underground space between the foundations of the building. On a bright summer day there was only the light available from some narrow dirt-encrusted windows on the level of the adjoining footpath, and into this space both urinals and water-closets ventilated direct. I was told that it was impossible to close the school because there was no other accommodation for the children, and as to making improvements—it

was a "non-provided" or denominational school, and the managers had no funds. That, of course, is typical of hundreds of schools all over the country. If the millions that have been spent on medical inspection and treatment had been spent on knocking these places down and building decent schools, schools comparable to the modern admirable "Council schools," we would then have had some right to start curing ailments as they arose. As it is we compel thousands of our children to spend a quarter of their childhood under conditions of sanitation which if permitted in a prison would set every sentimentalist in the country howling with indignation.

There is no reference in the annual reports of the chief medical officer to the sanitary conditions of existing schools, for the simple reason that no reference to this painful subject is made in the individual reports of the school medical officers; and I know why. I once published an accurate survey of the sanitary conditions of the schools in my area. I was young then and did not understand the mentality of our "educationists." But I never did it again, and would advise my colleagues to postpone any such report until they are on the eve of resigning their appointment. Perhaps the National Union of Teachers is strong enough to take the matter up in the interests of its own members as well as of their pupils. Personally I hold that the time has gone by when children should be forced into utterly insanitary surroundings in the interest either of sectarian religion or the process described as education, and to give "instruction in hygiene" under such circumstances is merely a cynical farce. It is the old story of deliberately creating disease and establishing costly methods of treating it. If the treatment is carried out by a State service it is "preventive," presumably if done by the general practitioners it does not deserve this label.

Time forbids anything but a passing reference to our latest and probably our least successful "stunt"—the campaign against venereal disease, on which we are now spending, I believe, a little short of a million a year, but it is difficult to obtain anything like accurate figures. Professor Robertson of Birmingham has rightly protested against the statement that 10 per cent. of the population were suffering from venereal disease. This estimate, solemnly adopted by a Royal Commission, was made when there were no data available for making any estimate at all, and it is obviously contrary to common experience. Practical preventive measures are objected to by those who regard the fear of disease as in some way a buttress of morality, so we spend our money on a method of treatment which we are now told is not effective unless the patient is kept under observation for at least two years. It therefore differs from the old-fashioned treatment by mercury and iodides only in being more troublesome, more costly, and more dangerous. These were the diseases for the cure of which patients were most willing to pay, but now the taxpayer must meet the bill in order to minimize a risk which very few incur except deliberately. Now that venereal disease has become a fashionable topic for drawing-room conversation, it is surely time that we pulled our head out of the sand, adopted compulsory notification, and made the subjects of disease pay for their treatment according to their means. Here again we preach a conventional morality to people for whom we have made marriage a practical impossibility by the promotion of poverty and the failure to provide economic housing.

My conclusion from all these considerations is that we have turned away from the ideals of the Public Health Act, from the improvement of environment which produced such incontestably good results, long before work in this direction was completed—when, in fact, it was little more than begun—and that we are depleting the funds required for this work by a costly and partial treatment of the end-results of the processes inaugurated by faulty environment; that we are bleeding the taxpayer and the ratepayer by expenditure that does not give an adequate return in improved health and prolonged life; that we are undermining responsibility by providing services at the public expense which should be paid for by the individual, and incidentally depriving the private practitioner of a large part of his legitimate opportunity of exercising his calling.

DISCUSSION.

Dr. MEREDITH SANDERSON (Sanitation Officer, Nyasaland) commented upon the fact that often the greatest public health benefits resulted from the use of some simple and inexpensive measure applied at an opportune time. As an illustration he described how he had dealt successfully with widespread ankylostomiasis in his district by the installation of pit latrines that were carefully supervised.

Dr. HAROLD KERR (M.O.H. Newcastle-upon-Tyne) admitted that Dr. Wynne's contribution contained much truth, but it was tinged with bile. Newspaper "stunts" were of some value in so far as they were indicative of public interest in health subjects. All medical officers of health suffered at times from the misdirected efforts of amateur enthusiasts, but the fault lay with the medical profession in passively maintaining a vested interest in established disease. An infusion of the principles of preventive medicine into the profession at large would counteract this tendency. He advocated well-organized propaganda—such as was found in the chief health departments in America—as a means of educating public opinion in the essentials of hygiene.

Dr. W. W. KING (Public Health Service, U.S.A.) deprecated the pessimistic view of public health. Imagination was necessary to see things from a future standpoint. Present-day public health work was open to the charge of being too individualistic, but then it was only in the swaddling-clothes stage. Improvement in environment was necessary to correct the disabilities it produced in infants, school children, and factory workers. The facts could only be obtained by a study of the individual. When the conditions were known the methods of prevention could easily be determined.

Dr. ELIZABETH BELL (Belfast) and Dr. ELLINGWORTH (Melbourne) also took part in the discussion, after which Dr. WYNNE replied to the effect that we should pay more attention to relative values in public health, and not strive after the perfection of particular branches to the exclusion of fundamental aims.

A CONSIDERATION OF METHODS OF SEWAGE DISPOSAL IN THE TROPICS,

WITH SPECIAL REFERENCE TO HELMINTH INFECTION.

BY

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[*Abstract.*]

DURING the recent expedition to British Guiana from the London School of Tropical Medicine the helminthological aspects of sewage disposal were investigated. The inhabited part of British Guiana is a primitive country, lying for the most part below sea-level and without any organized general sanitary system. In certain of the towns and villages the following methods of sewage disposal have been introduced: (1) pit latrines, (2) pail closets, (3) latrines erected on drainage trenches, and (4) septic tanks. Dr. Khalil described the different methods and discussed them from the point of view of helminth infection. He discovered that hookworm ova are not destroyed by these methods and subsequently continue their normal development. He arrived at the following conclusions:

Sewage disposal has been considered in England and Europe chiefly from the point of view of bacterial infection, particularly as regards the enteric group of organisms. The protozoal and helminthic infections propagated by faecal contamination have received no attention. In textbooks on sanitation and hygiene the entozoal parasites of man are dismissed in a few lines, mostly incorrect, and copied from one edition to the next without keeping pace with the rapid progress in tropical medicine. There is a tendency in England to dissociate sanitation and hygiene of warm climates from that of cold climates. With the facilities of communications now available this distinction is unjustifiable. Tropical diseases are being introduced into colder climates and vice versa. Moreover, this country contributes a high percentage of the medical men and sanitarians located throughout the tropics. They are apt to copy what is done or what they were taught in England, neglecting the new factors appearing in their new environments. It is not surprising that in British Guiana and elsewhere sanitarians have diligently made cultures to isolate *B. typhosus* and other organisms from drinking water and sewage effluent, and were totally unconscious of the presence of the comparatively gigantic ova of hookworm and other parasites. In tropical countries the

disasters brought about by hookworm disease often surpass those due to bacterial infections. Hookworm disease retards the development of children, handicaps their mental capacity, deteriorates the value of adult manual labour, predisposes the community to various diseases, and in addition claims a grave toll of mortality. It is not to be concluded that bacterial investigation of water and sewage is unimportant, but it is claimed that protozoal and entozoal infections must receive due attention as well.

Bacterial purification of sewage is apparently inefficient as regards Helminth ova. It is unjustifiable to turn the effluent from such installations into rivers or canals which are used for drinking purposes, as is the routine in England. It should be kept in mind that filtration is inefficient in excluding hookworm larvae, which are capable of passing through several layers of filter paper and can penetrate the human skin. Sewage farms ought not to be encouraged in the tropics as they act as veritable concentrated cultures of hookworm larvae. One cannot wholly condemn these methods of sewage disposal, because so far there is nothing better to replace them. It is only urged that their limitations must be kept in mind till further research and observations rectify their defects.

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SHOULD WE LONGER TOLERATE THE POLLUTION OF THE AIR?

BY

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THERE are many reasons why we should not tolerate any longer the pollution of the atmosphere. The most important of them all is the one specially suitable for your consideration as medical men, and that is the effect on health and life of living in air polluted by smoke and noxious vapours.

Many people seem not to realize that we are constantly passing air through our bodies; breathing goes on so automatically that we forget that we pass through our lungs about 516 cubic feet of air, weighing 38½ lb., per diem. We are conscious of taking solid food and liquid—probably about 6½ lb. weight per diem—and we take great precautions against them being in the least degree impure or contaminated. We have the Food and Drugs Act in operation and our water supply is under strict supervision. We select for use only water that is pure enough to be safe; contaminated water is not allowed to get into the mains. But we have only one supply of air; we cannot get air from any other source, or even filter it; we must breathe what is around us wherever we happen to be, no matter what its impurity or condition.

Many theoretical opinions have been given about the effect of smoky air on health. I have heard it stated that it causes no injury to health; some have even asserted that it is a benefit, because a smoky atmosphere acts as a disinfectant. We know that sulphurous acid is a disinfectant, and would be quite good if it could be sprayed on where it is wanted; but these people forget that we have to inhale this disinfectant, and that its presence in the bronchial region and lungs is irritating and harmful, just as inhaling or swallowing any other disinfectant would be. An atmosphere of chlorine would be a more powerful disinfectant, but it would be still more harmful to inhale; in fact, we may say generally that the more powerful a disinfectant is, the more deadly it would be if taken into the body, either by the lungs or stomach.

But I prefer to take practice rather than theory, and to illustrate the effect on health I will take one of the worst examples I have experienced. This was a most extreme case, but the same thing goes on in a lesser degree every winter, in every town in Great Britain, but not in some other countries.

In Glasgow, during the winter of 1909, we had a series of exceptionally bad fogs; we have had nothing like them since, and I hope we never will. It is usually very difficult to get a true standard of comparison in such matters, but I claim that I have it here. The Registrar-General, in his returns, forms a group of the eight principal towns in Scotland; they are Glasgow, Edinburgh, Dundee, Aberdeen, Paisley, Leith, Greenock, and Perth. The population of Glasgow at that time was estimated by the Registrar-General at 872,021, and that of the other seven towns combined at 993,550. In all but one of these towns the conditions are practically alike: they are planned and built in the same style; they have about the same proportion of crowd and even slum areas; they have good water supplies, similar systems of sanitation, the same forms of control and inspection; the methods of heating and cooking are similar; and the general habits of their inhabitants are very much alike. Even the working conditions are comparable, as most of the industries in Glasgow are also carried on in one or more of the other seven towns. But their geographical positions make it improbable that they all should have quite the same conditions of atmosphere at the same time. A glance at the map will show this—three are on the west, two on the east, and three north-easterly; five are on the coast, and three are inland. A drift of air from the east will carry smoke over some while it carries it away from others; from the west it will pollute some and clear others. I have made no comparisons with rural or semi-rural areas, because many of their conditions vary from the large towns.

I remember reading what the late Dr. Russell, Medical Officer of Health for Glasgow, once said: "That during winter every city was in danger of a catastrophe if certain weather conditions occurred—a combination of keen frost, fog, and a still air for days together." Having experienced that condition, I got the Registrar-General's returns as soon as published and studied them; I compared them with the atmospheric condition in Glasgow as I had noted it day by day, checking it with the meteorological records, and I submit them for your consideration.

During the summer of 1909 in Glasgow we reached the lowest death rate recorded up till that time—about 11 per 1,000. It rose a little as the winter came on; for the five weeks ending October 30th the weekly average number of deaths from all causes was 223, equal to 13·4 per 1,000 per annum; and for the other seven towns the number was 233, equal to a rate of 12·2 per 1,000.

On October 30th and 31st we had a fog, and for that week, ending November 6th, the number of deaths was 304—equal to 18·2 per 1,000—while the rate for the other seven towns was only 12·7. The following week, ending November 13th, the Glasgow rate remained at 18 per 1,000, the other seven towns rising to 13·9.

From November 15th to 19th we had one of the worst fogs I remember, and for the week ending November 20th the number of deaths was 416—equal to 24·9 per 1,000—while for the other seven towns it was 15·3. For the following week, ending November 27th, Glasgow had 547 deaths—equal to 32·7 per 1,000—while the other seven towns were 16·7 per 1,000. During the week ending December 4th the Glasgow death rate dropped to 27·3 per 1,000, the rate for the other seven towns rising to 17·8; but during the following week, on December 6th, 7th, and 8th, Glasgow had another fog, and for this week, ending December 11th, the number of deaths in Glasgow rose to 529—equal to 31·7 per 1,000—while in the other seven towns it fell to 16·7. From then it began to decline in Glasgow, but increased in the other seven towns.

The next point was to see what class of diseases had caused this abnormal increase of deaths, and it was found that those affecting the respiratory organs, called bronchial diseases, including bronchitis, pneumonia, and pleurisy, were accountable for most of it. [The speaker showed a diagram which indicated that the increase of deaths was caused by the diseases of the organs principally liable to injury by impure air.] No doubt cold caused an increase in deaths from these causes, but that applied even more to the other seven towns, where the temperature was slightly lower than in Glasgow, but there was something more than cold, and as every other condition was similar except the impurity of the atmosphere, I am convinced that was the cause.

After increasing the Glasgow death rate for November and December above the October rate in the same proportion as the other seven towns, there was still an excess over that increase of about 1,000 actual deaths, and those were mostly among the very young and the old; these excess deaths I attribute to the impure atmosphere that the population of Glasgow were compelled to breathe. This was an extreme example, but it indicates what occurs in a lesser degree in any district whenever

the air is polluted, and probably the death rate from bronchial diseases in excess of that due to cold and damp will be in almost direct ratio to the amount of impurity. I have said nothing about the effect on phthisis or other forms of tuberculosis; owing to the lingering nature of this disease weekly or even monthly returns would be unsuitable for comparison.

If that was the death rate, what must the case rate have been? Your experience will tell you for each death how many cases of illness there probably were that caused suffering and distress but did not end fatally. Then there is the injury caused by the absence of direct sunlight and the weakening of the actinic properties of light.

Why do we continue to tolerate such a condition of atmosphere that injures and kills so many? Partly because there being nothing conspicuous or dramatic about its effects we hardly realize the connexion between the cause and the effect. If a chimney stack occasionally fell down and killed a few people we would immediately get laws passed that none but steel chimneys should be erected, and that they should be so efficiently stayed that a fall would be impossible. Partly also because we do not realize our own individual responsibility. Most people say, "somebody should do something," but many of those who shout the loudest do nothing themselves.

From whence does most of this death-dealing smoke come? Very largely from the chimneys in our own houses, offices, warehouses, hotels, etc., wherever raw coal is burned in a kitchen range or open grate of the domestic type. Even in most manufacturing towns more smoke comes from the domestic chimneys than from the factories. In Glasgow in winter time as much as 70 to 80 per cent. of smoke is domestic, except when the wind is east and smoke from the Lanarkshire "black country" is blown over the city.

We have laws to prevent factory smoke, though by many local authorities they are not put into operation and never by the Ministry of Health; but we have no powers to take action against domestic smoke, and there you can help us. Your profession takes you into the houses of all classes of our people and you have their confidence, so that suggestions and advice from you carry more weight than from others.

Fortunately we have now methods of cooking and heating that are smokeless, more convenient, save labour, and are not more costly, sometimes even cheaper, than the old-fashioned cooking range and open grate. In the construction of all new buildings, whether factories, warehouses, offices, or dwellings, all smokeless methods cost less to install than the old smoky methods.

To change over from old conditions to new does entail some expense; new fittings and their installation have to be paid for; but even then the saving of labour and the curtailment of other expenses, with the increase of convenience and cleanliness, in time will repay the outlay. In most existing buildings one hesitates to recommend putting in an installation of central heating, as it entails considerable alteration and expense, although for new buildings it is an ideal system; but gas and electricity are easily installed without much trouble and at a fairly moderate cost, and with reasonable care economical in use. The greatest obstacles to change are apathy and prejudice. The apathetic generally regard attempts to improve anything as hopeless and they want to be let alone.

Against the use of gas there has been a strong prejudice in the minds of many—a prejudice now without reason. In the earliest forms of gas fires, and in their indiscriminate adoption, there were some grounds for complaint. In many instances, where a coal grate did not do well, owing to some defect in the chimney causing the smoke to come into the room, a gas fire was put in because there was no smoke from it, but as the products from combustion came into the room, the gas fire was blamed and not the chimney. Then gas fires were put into fireplaces where the area of the chimney was far too large. The flue from a coal fireplace was made much larger than was actually necessary to carry off the products of combustion, because room had to be left for a considerable amount of soot to deposit on the sides without quickly choking up the flue and curtailing too much its area, so that it would not require to be swept at too frequent intervals. Such a flue area is too large for a coal fire under normal conditions, and is one cause of down draught, especially when a fire is being kindled, owing to the weight of the column of cold air in the flue chilling and pressing back the small volume of warm air trying to rise. A proof of this is that nearly all cases of blowing down of smoke are caused by putting on the top of the chimney a galvanized iron "narrowing can" to curtail the draught.

When a gas fire is put in place of a coal grate, the top of the chimney should be narrowed to a diameter that will allow all the air in the room to be changed about four times an hour, which is quite sufficient for ventilation. A coal fire usually passes enough to change the air about ten times an hour, much more than is necessary, causing draughts and even lowering the temperature in some parts of a room, between the door or window and the fireplace.

To ascertain if there were any grounds for prejudice against gas fires, the Corporation of Glasgow, in 1908, instructed Mr. Harris, the corporation chemist, Mr. Fyfe, chief sanitary inspector, and Mr. Wilson, gas engineer, to investigate and report. Under their direction, in two houses similar in every respect, a long series of tests were made with a coal fire in one and a gas fire in the other, which proved that a gas fire was as healthy in the house as a coal fire; that it did not "dry the air," but that the humidity of the air in each room was practically the same; that fumes did not come into the room in one case more than in the other. That after lighting, the temperature rose much more quickly in the gas-fired room and remained constant and under complete control, while in the coal-fired room it fluctuated considerably and was not under control. They found that with a coal fire "at least 75 per cent. of the total heat generated by the combustion of coal in an ordinary fire is lost in the form of flue heat"—that is, at least 75 per cent. of the heat went up the chimney, only 25 per cent. being radiated into the room. With a good gas fire 26 per cent. of the heat generated went up the chimney, 74 per cent. going into the room. Since then improved forms of gas fires lose still less heat up the chimney and radiate more into the room. As to cost, they said:

"We are of opinion that, even when fires are required for continuous daily use, if gas is burned in properly constructed grates or stoves, and the cost of service for attending coal fires, and the extra work entailed in dusting, sweeping, and washing because of them, are added to the price of the fuel, the cost of heating by gas compares very favourably with the cost of heating by coal. When domestic cooking alone is the consideration, or when rooms require to be rapidly heated and kept at an even temperature for short periods, gas fires are not only more convenient, but will cost less than coal fires, even with gas at its present price."

As to the effect on the atmosphere Mr. Harris's analysis of the flue gases proved that over 5 per cent. of the coal used passed up the chimney into the air as solid impurities, consisting of:

Mineral matter	22·0 per cent.
Carbonaceous matter	41·1 „
Oily hydrocarbons	36·9 „

"These impurities are most objectionable, as besides being conducive to the formation of that abomination—black fog—they retard its dispersion, because on a reduction of atmospheric temperature they are condensed and precipitated with the accompanying moisture, forming an oily envelope surrounding the globules of condensed water, which prevents evaporation to a very considerable extent."

They concluded the report by saying:

"We feel assured that, after a careful study of the facts and figures herein presented, the citizens will readily acknowledge that the smoke-producing, wasteful domestic coal fire must be replaced by the more cleanly, evenly, and healthy gas fire before we can hope to obtain a purer atmosphere, or even begin in earnest with the work of air purification."

Then we have electricity, which now has become quite practicable for domestic purposes, and, used intelligently, is quite economical for cooking and heating. One of its advantages in a house is its adaptability. It can be used for cooking, warming rooms, doing the washing and ironing, running the vacuum cleaner, and driving the sewing machine. Electric radiators can be placed anywhere as no flues are required; it is not necessary to warm the whole of the room, the radiator can be placed just beside one so that anywhere in the room one may be "sitting at the fireside."

In many places, unfortunately, the charge for current is still too high. In Glasgow we find it pays the electricity department

to sell current to domestic consumers—who are paying 4½d. a unit for lighting—at the rate of 1d. a unit for all other purposes, because for these uses it is generally taken at hours of the day when we have plenty of current to spare; very little is wanted when the lighting load is on.

No one can know better than you the advantages of gas or electric heating in cases of illness—a constant source of heat, day and night if required, with the temperature under control; the patients not disturbed and the attention of the attendants not taken up by frequently putting on coal and removing ashes; no danger of causing a down draught by having the window open or closed as desired.

As there are so many advantages that smokeless methods in the house possess over the old dirty coal fires, possibly compulsory legislation may not be required—the change may come of itself without compulsion.

As regards industrial smoke, there is a constant change over to smokeless methods because they are more efficient and more economical. Now it does not pay a manufacturer to produce his own power, to have his own boiler, chimney, engine, and all the necessary shafting and belting to carry the power through the the factory, and the whole kept running when perhaps only a few of the machines are actually working. These can be dispensed with, and the room they occupy saved, the power being led through the factory by a pair of thin wires and applied by a small motor attached to each machine or tool, and current only used while that machine is in use. This also results in a great saving of coal; our electricity department can supply at the factory one horse-power for one hour with a consumption of less than 1½ lb. of coal; a boiler and engine in a factory would use three to four times this amount of coal per horse-power. But there is need for more stringent legislation and for more compulsion on local authorities to use the powers they already possess.

There are Acts of Parliament making it an offence to emit smoke from factories, etc., but they contain many defects and some of them are difficult to put into operation, and very many local authorities absolutely refuse to take any action to enforce them. So much has this been the case that it has been recommended in the Report of the Departmental Committee on Smoke and Noxious Vapours Abatement, that the Minister of Health should be given clearly defined powers to compel a local authority to take action against offenders, and failing their taking action the Minister of Health should take the necessary action.

It was clearly proved in the evidence given to that committee that nearly all industrial smoke was unnecessary and wasteful, and could be avoided. There are a very few processes in which the presence of a certain amount of smoke is necessary, such as rolling thin sheet steel, or where a reducing flame is necessary to prevent oxidation. In such cases, I recommended "that the Government should stimulate and if necessary subsidize research with a view to discovering an efficient method of catching or consuming the smoke before it passes into the atmosphere. When such a method is found, its adoption by manufacturers should be made compulsory, and local authorities should be empowered to make a contribution, if they desired, towards the cost of installation and its maintenance."

If it could be shown that in any process it would add to the cost of production to treat the smoke and prevent it getting out into the atmosphere, I am of opinion that the cost of so treating the smoke should be paid to the manufacturers out of the health rate of the area in which the works were situated. The chances of having to make any payment are remote, and could only occur in a very few cases throughout the whole country; and even then the amount would be small. With the exception of certain operations in steel workings, all the evidence has proved that methods that prevented smoke saved money to the manufacturers. To quote one instance of this: We were told by certain witnesses that in making and glazing certain kinds of pottery ware it was impossible to fire it without making a great amount of smoke; that gas was not suitable for firing such articles; yet, within a few hours of hearing that evidence, we saw the firing being done with gas quite successfully and with a considerable saving in the cost of fuel.

We in Glasgow spent a capital sum of about 2½ millions and a charge of £300,000 a year on our sewage purification scheme that we might have a clean river, and we spend annually in the health department about £750,000 to prevent illness by the spread of infection; therefore it seems to me reasonable that a community might pay a little to prevent illness and improve the amenity of their district by preventing any pollution of the air by smoke and noxious vapours, should such a contribution be necessary.

If other cities and towns care to continue to wallow in a filthy atmosphere, their improvement seems rather hopeless. We in Glasgow have decided that we will not do so; we are doing all we can to make our atmosphere clean, and we are going to insist that our near neighbours shall not be allowed to send pollution into the air that is carried from them over our city—air that we have to breathe and live in.

DISCUSSION.

Professor Leonard Hill initiated the discussion by stating that smoke abatement should be one of the fundamental objects of public health. From every point of view a smoke-laden atmosphere was detrimental. The presence of smoke indicated excessive waste of thermal energy. A comparison of thermal units used in the ultimate production of electric light from burning coal and those expended by a glow-worm showed how very far this country was from the economy of nature. Distillation of coal on a grand scale would save the valuable by-products and still produce sufficient thermal units for manufacturing and heating. Smoke caused fog, and fog caused delay, annoyance, and financial loss, as well as loss of health. It destroyed vegetation in the neighbourhood of towns where it was most needed; it shut off sunshine in the places where it was most necessary; its effect generally was depressing and lowering; it was unnecessary, and, most important of all, preventable.

Dr. T. M. Legge (Home Office), in undertaking a partial defence of the smoke bogy, protested against the lack of a sense of proportion in this indictment of the smoke nuisance. There was a "stunt" just now in favour of the gas fire against the open fire. The open fire meant a free current of air in the living room, and he could imagine nothing more unwholesome or disgusting than the smell of cooking from the gas stoves installed nowadays in almost every little tenement. Coal was essential to most metallurgical processes, and the pall of smoke which lay over manufacturing towns was a monument to man's industry and his triumph over matter. He was not in favour of substituting gas for coal in heating. Gas supplied for this purpose was highly dangerous on account of the carbon monoxide it contained, and deaths from gas poisoning were occurring with increased frequency. The smoke problem had gradually grown up with the progress of industry, and could not be instantly abolished.

Ex-Bailie Smith, in reply, said the speakers had left him little room for reply. He had studied this question for a long time, and was absolutely convinced that smoke did far more harm than was realized. He hoped everyone in his own district would do a little to "clear the air."

DISCUSSION ON THE TRAINING FOR THE D.P.H. AND THE NEW REGULATIONS.

OPENING PAPER

BY

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Prior to the passing of the rules which will in due course become operative, certain observations were submitted by me from which it will be seen that the broad general lines decided upon were in my view necessary.

I have had an experience, extending over a great many years, of the teaching of the subject of public health, and the course of instruction in Liverpool has been modified and moulded upon such lines as are calculated to meet the needs of the modern medical officer of health.

As a present or past examiner in the subject in various universities—namely, Liverpool, Manchester, Belfast, Cambridge, Edinburgh—and at the examination of the Royal College of Physicians of London and the Royal College of

Surgeons of England I have been impressed with the fact that, either from lack of opportunity or want of attention on the part of the candidate, he or she is frequently deficient on matters more or less essential, of which, given the opportunity and reasonable diligence, a full knowledge might have been acquired.

The existing regulations of the General Medical Council are themselves revisions and advances upon those first called into operation, and I am of opinion that, in so far as they relate to the two important subjects of chemistry and becteriology as applied to public health administration, they do not call for change. These courses are short—namely, three months for each—and consequently they do not make a great demand upon the time of the candidate. I fully recognize that the medical officer of health has in almost every case the opportunity to consult with those upon whom the duty of chemical analysis and bacteriological examination falls, but notwithstanding that, it is in my view an incalculable benefit to the medical officer if he has acquired a sufficient knowledge of these subjects to enable him to appreciate the methods and results. It is quite likely, however, that some modifications in the examination may be thought desirable.

The modern medical officer of health is most concerned with practical administrative details, and with the methods of application of various Acts of Parliament and the numerous orders of the Ministry of Health and of the various Government departments designed with a view to improve the public health. It is with the daily application of these that the medical officer of health to-day is chiefly interested, and the curriculum should afford to every candidate opportunities, full and varied, to become practically familiar with them.

In my view, the time allocated—namely, six months—is sufficient for the purpose, notwithstanding that either chemistry or bacteriology may be taken during part of this period. The difficulty, however, consists in the lack of opportunity at some of the districts in which the student may be placed. At present the population basis alone is taken as a criterion of adequate teaching equipment, without regard to the fact that a population of 50,000 may be, and frequently is, so happily placed as to render active sanitary operations unnecessary, whilst other examples are not far to seek where a very partial sanitary equipment appears to meet local needs. The consequence is that many candidates are received for instruction in localities with very limited scope for training, and the conditions are widely different from those districts in which the maintenance of the public health presents constant and insistent demands. I would suggest, therefore, that, if a population basis is retained, it should only be on condition that adequate opportunities for training are available to the entire satisfaction of the Public Health Committee of the General Medical Council. Alternatively, the propriety of combining areas for teaching purposes with the mutual agreement of the authorities concerned might be considered. It is most desirable that all sanitary authorities, especially the larger ones, should give facilities to students to acquire practical knowledge. There has been one conspicuous instance where opportunities were withheld.

In deciding the districts in which the students may be allowed to train for their practical work it is worth considering whether the authorization to undertake the practical training of students for the Department of Public Health should be limited to whole-time medical officers of health. This would obviate the necessity for combining areas, but it would not wholly meet the difficulties experienced.

One further point deserves consideration. Many candidates who present themselves for examination have obviously been handicapped by reason of the fact that they were carrying on other onerous duties during their period of study. The General Medical Council might think it expedient to advise candidates to limit their extraneous duties, during their period of study, to kindred subjects, such as attendances at welfare, venereal diseases, or tuberculosis centres, or at fever hospitals, or to school medical inspection—always provided that these duties are not of so extensive a character as to make undue claims upon their time. Possibly some recommendation of a similar nature in regard to general practice might be advantageous. It is not suggested, however, that the candidate should be barred absolutely from undertaking any other duties, but a timely warning as to their limitation would be useful.

As an indication of the field over which the practical instruction ought to extend, a draft of the syllabus followed in Liverpool is appended. No doubt it represents fairly closely the course adopted in many of the large teaching centres.

The rules as finally approved will, I am sure, be highly beneficial. The extension to two years of the interval between the attainment of a registrable qualification and the admission to the examination for the diploma is very necessary, and the lengthening of the curriculum will ensure for the candidate reasonable time in which to obtain the necessary knowledge. It will be noted also that under Rule 6 many of the "schemes," though of comparatively recent introduction, are yet highly important and receive due emphasis, while the increase in the population limit is, I think, very wise.

The General Medical Council is to be congratulated upon taking this important step in improving the curriculum for the Diploma in Public Health.

CITY AND UNIVERSITY OF LIVERPOOL.

DEPARTMENT OF PUBLIC HEALTH.

Syllabus of Practical Course in Public Health Administration, etc.

I. Interviews with Ministry of Health as often as possible.—Forms and methods of official reports; correspondence.

II. *Housing and Town Planning.*—Housing and town-planning operations.—Lay-out, width of streets, houses per acre, etc.—Artisan and labourers' dwellings.—Cellar dwellings, courts, and alleys.—Unhealthy areas and insanitary property.—Rehousing schemes.—Transport.

III. *Planning and Inspection of Buildings.*—Building by-laws.—Building construction, materials, foundations, etc.—Better-class houses.—Public buildings, ventilation, etc., of.—Emigration houses, common lodging houses, and sublet houses.—Methods of examination of sanitary arrangements, smoke test, etc.—Ventilation, heating, lighting, water supply.

IV. *Water Supply, Sources, etc.*—Baths and wash-houses.

V. *Scavenging and Cleansing.*—Collection and disposal of refuse.—Destructor.—Electric power station.—Utilization of waste products.—Street washing.

VI. *Sewage Disposal.*—Sewers and drain construction.—Cesspools.—Sewage farms.

VII. *Disposal of Dead.*—Mortuaries, cemeteries, crematoria.

VIII. *Food Supplies.*—General Administration.—Methods of procedure under Public Health Act and orders relating thereto.—Sale of Food and Drugs Acts.—Sampling, etc.; margarine and butter blending factories.—General milk supply.—Cowsheds: registration, control, and regulation.—Abattoir and private slaughter-houses; meat inspection, evidences of unsoundness; wholesale markets.—Preparation of foods; for example, sausage factories, shops, and sale of meat retail.—Fruit and fish markets: construction, arrangement, and inspection.—Importation of foodstuffs; cold storage (see Port Sanitary Department).

IX. *Industry and Occupation.*—Bakehouses, factory and "underground."—Margarine works, biscuit factories, etc.—Workshops, administration of, etc., under Shop Hour Acts, Employment of Children Act, etc.—Offensive trades, knackers' yards (disposal of unsound meat and of diseased animals).—Stables.—Hide markets, gut scraping, etc.—Suppression of smoke nuisances (boilers, furnaces, steamers, etc.).

X. *Infectious Diseases.*—Hospitals, planning and administration.—Grafton Street and Fazakerley Hospitals (construction and administration).—Infectious diseases inquiries (sources of infection, contacts, library books, etc.).—House to house inspection.—Disinfection and cleansing of infected houses.—Disinfectors.—Small-pox, measles, whooping-cough, etc., special preventive measures.

XI. *Venereal Diseases.*—Clinics and hospitals.—Other centres.—Details of scheme as approved by the Ministry of Health.

XII. *Tuberculosis.*—Special preventive measures.—Colony.—Sanatoriums.—Institutes and dispensaries.—Scheme as approved by the Ministry of Health.—After-care.

XIII. *Infant and Maternal Welfare.*—Infant welfare centres, day nurseries and hostels.—Ante-natal centres.—Rest homes.—Administration of Midwives Act; stillbirths, ophthalmia wards.—Milk for infants: depots and distributing centres.—Welfare schemes, as approved by the Ministry of Health.

XIV. *Child Welfare.*—Schools, elementary and industrial: construction, accessory buildings.—Medical inspection of schools and of school children.—System of supervision and after-care school clinics (ringworm, minor ailments, eye, dental, etc.).

XV. *Port Sanitary Administration.*—General procedure in regard to infectious disease.—Special methods under plague, etc., orders of the Ministry of Health.—Boarding stations and quarantine grounds.—Aliens' Immigration Orders.—Sanitation of vessels;

crews' quarters; emigrants' quarters.—Disinfection of ships; deratization.—Supervision of dock areas.—Cargoes, and disposal of waste.—Importation and storage of foodstuffs.—Canal boats, registration and supervision.—Transport of live animals, cattle boats, trucks, lairages, etc.

XVI. *Executive Duties.*—Sanitary and special inspectors, and of health visitors and female inspectors.

XVII. *Health Enactments and their Application.*—Acts of Parliament and orders made thereunder affecting the public health.—Statutory notices.—Preparation and nature of evidence.—Attendances at law courts, at proceedings, and at inquiries.

XVIII. *Vital Statistics.*—Methods of compiling mortality statistics.—Estimation of population.—Calculation of birth and death rates.—Preparation of Government returns.—Records of infectious cases.—Hospital registers.

XIX. *Special Reports* by students on some of the foregoing.

XX. *Special Visits* to cases of plague, small-pox, or tropical diseases when opportunities arise.

DISCUSSION.

Dr. T. M. LEGGE referred chiefly to Rule 6, and questioned whether the full-time medical officer of health was the best person to give instruction to the pupil, for he was divorced from the general practice of medicine and fulfilled so many other offices that there was danger of his being jack of all trades and master of none.

Dr. HAROLD KERR (M.O.H. Newcastle) expressed his admiration for the excellent and thorough training given at the Scottish universities, but he wondered how it was carried through and how candidates could be induced to take it up. In his experience about half the entrants, after paying the fees and taking the course, did not sit for the examination. The ordeal was hardly worth while, for the public health service offered the poorest financial outlook and very little chance of professional distinction. The new regulations, in his opinion, were overloaded with preliminary technical work, valuable no doubt, but not essential to a medical officer of health. As to Dr. Legge's objection to the full-time medical officer of health as a teacher, he took that as a compliment to his voracity for work, for in the public health service there were no "soft jobs" either in the way of work, worry, or wealth.

Dr. R. J. REECE (Ministry of Health) said that the net effect of the new regulations was to add another year of technical training at school. His experience as an examiner convinced him that the great defect in the majority of candidates was the lack of practical knowledge. He was certain that the new rules would cut down the number of candidates, and very likely those who did take up public health would take it up as a hobby and not as an occupation. As to the remarks of the previous speakers, he reminded them that industrial hygiene did not begin and end in a factory: the whole circumstances of family life must be taken into consideration.

Professor CARSTAIRS DOUGLAS (Glasgow) agreed that a revision of the regulations for the diploma in public health was necessary, and on the whole he was satisfied with it. As a teacher and examiner he felt that though the successful candidates deserved their diplomas, they had very little real knowledge of what public health work meant. In spite of adverse criticism he thought it was right to make an interval of two years between obtaining a registrable qualification in medicine and entering for the final D.P.H. examination. A year or two spent partly in hospital and partly in general practice was an excellent preparation for public health study. As to the training in chemistry, he thought this might with advantage be confined to a sound grounding in the analyses of water, sewage, milk, butter, and similar processes which the medical officer of health might be called upon at any time to perform.

Dr. PICKEN (M.O.H. Cardiff) maintained that public health students should devote the whole of their time to the work, otherwise they could not acquire a thorough knowledge. There was real difficulty in giving practical instruction in administration, for even the whole-time assistant was usually employed in a special branch, and was no better off in this respect than the man engaged in work outside the department. It was, nevertheless, almost absurd to ask men to give up more remunerative branches of the profession and devote their whole time to study so long as the attractions of the public health service were so small.

Lieut.-Colonel FREMANTLE, M.P. (Consulting C.M.O. Herts), protested that the D.P.H. course should be on broader, more academic, and truly scientific lines. First, applied physiology should be the basis, not chemistry or bacteriology, which were only useful accessories. Secondly, rural conditions should be considered the basis of healthy living, and everyone should work toward the decentralization of industry. Thirdly, the conception of health and disease in this temperate climate and in this congested country were cramped as compared with tropical and oriental life. Tropical conditions and experience played a large part in the general practice of public health. Fourthly, industrial hygiene must be taught by those experienced in it, but it was absurd for a Ministry of Health and for local health authorities and their officers to be excluded from that most important factor in public health.

Dr. A. K. CHALMERS (M.O.H. Glasgow), President of the Section, in closing the discussion, pleaded for a wide view of public health. It was not the six or eight hours a day spent in a factory that comprised the whole of a man's health circumstances; that was one aspect only, and it gave an imperfect view. He wished particularly to refer to Rule 6, which he considered awkwardly worded. If strictly interpreted, it would be impossible of application, but he understood that the certifying medical officer of health merely had to satisfy himself that adequate instruction had been given, though not by himself personally.

DISCUSSION ON ADMINISTRATIVE REQUIREMENTS OF THE VARIOUS TYPES OF TUBERCULOSIS.

OPENING PAPER

BY

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TUBERCULOSIS schemes aim at providing treatment of one kind or another for patients suffering from tuberculosis in its various forms, and are elastic enough to permit of a measure of what is called preventive treatment. The different types of case and the various stages of the disease have their several requirements, administratively described, in the terminology introduced with the National Insurance Act, as sanatorium, hospital, dispensary, or domiciliary treatment. At present these form the main component elements of tuberculosis schemes, the part played by each varying according to local conditions, and the conceptions of those responsible for administering individual policies. Schemes may be said to be complete when every eligible patient is able to obtain appropriate treatment with reasonable promptitude. Judged by this standard few schemes are adequate, and are in general mostly lacking in provision for the advanced consumptive, and for non-pulmonary forms of the disease.

This discussion is concerned, however, not so much with the rôle played by these services as with the various types of patient met with, and the manner in which official schemes, in operation or conceived, may be said to fulfil their requirements. For convenience, we may consider (1) what patients require administrative treatment; (2) the nature of this treatment (including isolation); (3) various accessories to treatment—for example, industrial employment, etc.

1. At the outset we are met by a fairly large class who require diagnosis. Precision in administration depends to a large extent on accurate as well as early recognition of the true nature of the patient's illness. It is necessary to say, though it may seem an obvious and trite remark, that, before qualifying for treatment, a patient should be suffering from tuberculosis. There is no doubt that many errors in diagnosis are made, partly because discrimination between tuberculosis of the lung and other affections which simulate it is often a matter of considerable difficulty, but partly also because of bias towards his particular specialty by the tuberculosis physician. The function of a tuberculosis dispensary should be as much to prevent erroneous diagnosis as to secure the early recognition of tuberculosis. A good many patients are treated as tuberculous owing to misreading of the symptoms manifested and of the physical signs detected. The medical

officer responsible for routine diagnosis should therefore be a competent physician and should have at his command adequate facilities for differential diagnosis, among which *x* rays have a very important place. Radiographs are extremely valuable, if studied in conjunction with the clinical evidence, and have an educative value in checking over-refinements in diagnosis, unless, of course, they are subjected to bizarre interpretations. In most doubtful or suspected cases observation at the dispensary will usually suffice, although there is a considerable group which require observation in a hospital ward before the true nature of the case is disclosed. Stress is laid upon this aspect of administration because recent experience has shown the importance of placing diagnosis and facilities for it in the forefront of a tuberculosis scheme. In a great industrial city like Glasgow there is a very large amount of chronic respiratory affection both in children and adults, sequels of successive waves of measles, whooping-cough, and bronchopneumonia, while the latter are particularly prone to chronic bronchitis and its complications. For another thing, one must bear in mind the grave consequences, material and mental, which often follow a diagnosis of tuberculosis. As an illustration of these remarks I may mention the following data from the experience of the past eighteen months at one of the tuberculosis dispensaries. Out of 109 cases sent for diagnosis to the dispensary by medical men in the neighbourhood, 20 were suffering from tuberculosis; the remaining 89 were variously diagnosed as follows—chronic bronchitis 63 cases, cardiac disease 9 cases, bronchiectasis 4 cases, the others being variously classified as pneumonia, no disability, silicosis, aneurysm, empyema, and gunshot wound of chest with fibrosis.

A brief reference may be made to another clinical group (where administration is rather helpless)—that is, those whose disease has made considerable progress before it is recognized. This class of case has not much lessened in number among the civilian population since tuberculosis schemes came into being. Unless the disease is introduced by a haemoptysis, or unless it is detected in a contact, the tendency is for the sporadic case to be recognized late rather than early, and by that time mischief to other members of the family has very often already been done.

Administration has also a duty, difficult to define, towards contacts in general. Apart from those who have definitely sickened, whether the infection which they may be presumed to have received will result in immunity or not there is no means of knowing. We can at least endeavour to maintain their general health in whatever way may seem best. In France, for instance, under what is known as the Grancher system, the children of consumptive parents are boarded out in the country. This procedure recognizes the fact that between reception of infection and sickening there may intervene a period of many years, the finally declared focus in the lung being the termination of a long process, the story of which is difficult to read. It was thought at one time that preventive treatment could be applied during this intervening period to certain selected clinical types with some degree of precision. Hence arose the effort to detect that very vague entity, the pretuberculous child, but it did not meet with much success. Short of the radical procedure of the Grancher scheme, the danger of massive infection may be reduced when the infective patient is taught to observe the rules of prevention, or, better still, when he is removed to an institution especially from a small overcrowded house.

2. We now come to the administrative requirements of the various types of the definite case. Institutional treatment here takes the form of the sanatorium or hospital. Generally speaking, the early case or case with good resistance goes to the former, and the advanced or hopeless case to the latter. Between these two types, however, there exist numerous clinical varieties of patient belonging to a vague generic group known as the "middle" or "ambulant chronic" type, composed of patients whose disease progresses slowly or fitfully, with intervening periods of quiescence, during which they are fit for moderately light tasks. This is a difficult group from an administrative point of view.

The various aspects of the declared case can best be discussed by reference to a concrete study of a definite section of a city population. Some time ago an analysis was made by Dr. J. A. Wilson and myself of the considerable group of ex-service men then in the city who were suffering from pulmonary tuberculosis, with special reference to their clinical condition and degree of disablement at the time. It is difficult to give an even approximate idea of the great variety of clinical types, but the following broad grouping may serve as a basis for discussion. There were in the city 785 ex-service men who had been notified as suffering from tuberculosis of the lung. Among these were 122 (15 per cent.) who could not be regarded as definite cases. Their disability was due partly to other lung affections, or to other than lung affections. The remaining 663 patients, accepted as definite cases, were in a variety of stages of the disease, as follows:

	Turban Classification:			
	I.	II.	III.	Totals.
Arrested	38	11	—	49
Quiescent	98	175	52	325
Active	36	133	120	289
Totals	172	319	172	663

The "arrested" group contains those who had been free from symptoms of toxaemia for over eighteen months, and the "active" group those who showed recent or present signs of activity. The "quiescent" or stationary group, composing one half of the total, is in the majority, while as regards extent of disease, a similar proportion falls into Stage II. An average adult male population would probably sort themselves out in much the same way, though there might be among them a higher proportion of advanced types. The chronic moderately advanced case is therefore the preponderating clinical type. A good many, probably the majority, of those in this group are fairly fit and able to do a fair day's work, their disability being proportional to the extent of the fibrotic change in the lung. Many of them have ceased to excrete bacilli in the sputum, or do so intermittently; they are constant attendants at the dispensaries in winter and infrequently during the summer months, when their symptoms become greatly alleviated or almost disappear.

But this is not the whole story as regards disablement. In a considerable proportion of cases the tuberculous affection of the lung is not the sole handicap. Where the major disease is active and advancing the presence of a complication may be a subsidiary element in the case, but it often happens that a mild and retrogressive tuberculous affection is overshadowed by the presence of a concurrent disability. This is particularly so where chronic bronchitis and tuberculosis coexist. In the above series of 663 cases the principal concurrent disabilities, excluding minor affections and including only those which gave rise to definite physical handicap, were: chronic bronchitis 104, other tuberculous lesions 11, other affections 15, heart disease and aneurysm 8, poor physique and deformity of chest 15, recurring pleurisy 8. Many with chronic bronchitis are quite markedly disabled; the tuberculous element is retrogressive; they appear to excrete bacilli often at odd intervals; if admitted freely to institutions they tend to silt up the accommodation; they are susceptible of scant improvement; and were it not for the fact that they are commonly homeless or indifferently housed, they would have little claim on administrative attention.

On the institutional side, tuberculosis schemes meet the requirements of these various groups by the provision of sanatoriums and hospitals either as separate or combined institutions. There is no doubt about the necessity for institutional provision for the advanced infectious case. The extent of this will, of course, vary with local conditions, and especially with housing conditions. Hospitalization of this type of case has always been one of the main objectives of the Glasgow scheme, principally because so large a proportion of the population live in small houses (13 per cent. in one apartment, 49 per cent. in two apartments, 21 per cent. in three apartments). Hospital, as apart from sanatorium, beds for tuberculosis of the lung in Glasgow have now reached the approximate number of 520 under the local authority, and 250 in Poor Law institutions by arrangement with the local authority. Apart from the public health value of this procedure, it is a much appreciated humanitarian policy. It will be observed that the large chronic ambulant group

described above receive such institutional treatment as they require in hospitals, and are often "in and out" several times during their long career. Whether this is the best way of meeting their requirements will be discussed presently.

3. Various schemes have more recently been proposed for amplifying administrative measures in the direction of training the consumptive in a suitable occupation, with which to re-enter employment, or actually providing him with a definite occupation suited to his physical capacity—this taking the form of the hygienic workshop or the village settlement.

We may now consider the various types of case to whom these proposals might apply. In regard to industrial training as an avenue to re-entry into employment, careful selection of candidates is essential. It will be convenient to discuss this with reference to the material comprising the group of 785 notified cases referred to above, taking them as an average sample of a male industrial population from whom candidates might be drawn. Of these, some 122 cases, not regarded as definitely suffering from tuberculosis, would first be discarded. Eliminating next those who are frankly disabled by advanced disease or reduced to low working capacity by other infirmities, a group of 230 patients would fall out of consideration. Apart from physical fitness, however, a man's suitability for training depends also on his character and temperament. For the purpose of training in a new occupation, in which a candidate has to make good in the future, a scheme should be such as to attract the best type of patient. From this point of view we were led to compile a group of some 191 cases who, from our knowledge of them, and apart from questions of physical fitness, would be unlikely to be suitable for a scheme requiring initiative and co-operation on the part of those participating in it. Some were quite frankly unsuitable, while others who seemed to have suffered loss or enfeeblement of the will power as a result of their disease would scarcely be fitting candidates, unless the psychological aspect of the disease was dealt with at the same time.

After eliminating these groups, there remain 242 patients, out of whom on careful scrutiny we might select 127 as representing the best possible types, both physically and temperamentally, composed of 18 "probably arrested" cases, 75 quiescent cases, and 34 with some activity still present. Looking at the members of this group more closely, it is necessary to consider the nature of their present occupation, the conditions under which it is carried on, and also the fitness of each to continue at his particular trade. All but twenty of these men were employed in skilled or semi-skilled occupations, many of which were not at all unhealthy. In the case of others, continuance at a particular trade would depend not so much on its nature as on the conditions under which it is carried on, so that the question becomes rather one of re-employment under more favourable conditions than one of training in a new occupation. In a few the trade itself was frankly unsuitable. All these considerations make the question of selection for retraining a somewhat complicated one. An important aspect of the question is the point of view of the men to be trained. The workman, in this part of the country at any rate, is shrewd enough to show concern as to his future prospects in the proposed new sphere of employment, and is averse to retraining without some assurance on this point. For these reasons training for the purpose of re-entry into employment would appear to be limited in its scope and might not attract the best types of workmen, unless associated with a scheme of "placing" the trainee later on. This is one of the points emphasized by Dr. Noel Bardswell in a recent report, in which he states that with the exception of twelve men settled at or by the institutions to which they had been sent for training, none of the 160 London men who had passed through training centres during 1918-21 were now employed at the occupation in which they received their training.

On the other hand, the village settlement would meet many of these points. It implies permanent employment under sheltered and hygienic circumstances, associated with housing conditions for the patient and his family beyond reproach. It would, further, by permitting adaptation of the character and amount of work to the physical fitness of the worker, allow of a fairly wide selection of candidates from among the various types of case, including many of the "chronic ambulant" group. Social suitability would then become the principal factor in selection. This scheme is subject to the broad criticism that, apart from the difficulties in administration and organization which would attend its adoption on a large scale, it would secure for the consumptive and his family every possible hygienic and economic advantage, quite beyond what could be attained by the majority of the population. On the financial side the initial cost would certainly be high. As regards running cost, the claim has been made—and it is possible that experience might show—that the combined expenditure now incurred in respect of invalidity due to tuberculosis in adult males suitable for such a scheme by the local authority, the Poor Law authority (in respect of the maintenance of dependants), and under the Insurance Act, might be little less than that of a measure of this kind, taking into account on the credit side the revenue which would accrue from the labour of the settlement. These points could only be tested by actual experiment. However admirable schemes of this kind would be for the individual, sufficient is not yet known about the natural history of tuberculosis to make it certain that, as a public health investment, they would justify their cost.

Reverting to the large ambulant chronic group described above, composed of me with more or less extensive disease, very often with other infirmities, and with a working capacity that varies with the season, we have seen that the only form of treatment provided is the hospital, which is commonly an annexe of a fever hospital where lack of interest and occupation tends to create a feeling of boredom and pessimism. If the problem of administration were simply the provision of employment, this could be accomplished by the hygienic workshop, whose scope and aims are well known. It is, however, impossible to deal administratively with this group without reference to their housing conditions, and the hygienic workshop would require to be associated with some simple residential accommodation for those who are indifferently housed. As a solution of the problem, this would be less expensive, though less ideal, than the creation of village settlements.

In the face of so many different aspects of the disease, with varying requirements, administration finds it difficult to choose definite lines of action. For an affection like tuberculosis, which is complex in its causes, there is no simple and straightforward policy. Administration tends to be cautious and to look for definite preventive and public health sanctions when confronted with new schemes of uncertain dimensions and cost, and to regard new policies in their widest possible application before allowing them to assume undue preponderance over other aspects of public health policy, among which improvement in the general health and in the conditions of life and work of the population generally take a prominent place.

In conclusion, reference may be made to the claim to treatment of the non-pulmonary forms of tuberculosis. Institutional facilities for this group are very inadequate, and the large number of advanced surgical affections met with will not diminish until there is sufficient and appropriate accommodation for treating them in their early stages.

DISCUSSION.

Dr. MARCUS PATERSON (Frimley Sanatorium) complimented Dr. Macgregor upon the clearness with which he had explained the present situation. There was one point upon which he (the speaker) claimed to have exceptional experience, and that was the hospitalization of the advanced case. The two difficulties which troubled him most were the local health authority, with their officers, and public opinion. Voluntary segregation was comparatively easy for the "good" patient, but the majority became impatient of the restraint of an institution. If, by way of reward for good behaviour, or of reconcilement to restraint, he allowed a patient to return home for a short time, the M.O.H. and his subordinates were up in arms against him for reinfecting the premises which they had so carefully disinfected. It was unfortunate that every patient in an institution had to be teetotal: if only public opinion would allow a wet canteen hospital administration would be an easy matter. Hygienic conditions and good food converted many of the very bad cases into freely ambulant cases. If these had had some special treatment—for instance, a new serum—the serum would get the credit, not the wholesome régime.

Professor CUMMINS (Cardiff) said that Dr. Macgregor, in calling attention to the large group of ambulant chronic cases, had put his finger upon the outstanding problem of all tuberculosis schemes. These cases were too advanced for sanatoriums and too well for constant residence in hospital. They were the most dangerous of all, for they invariably came from poor homes and were the source of repeated and formidable infection to younger members of the family. He attributed the high tuberculosis death rate amongst children under 4 years of age in large towns to the presence of these cases. He considered the village settlement the ideal scheme provided the necessary financial provision could be made and patients persuaded to go there. These were the objections raised by every member of the medical staff—all of them experienced tuberculosis officers—to the scheme which he had recently propounded to the Welsh National Memorial Association. Hope, he said, would entice the early case to the sanatorium, and despair would drive the late case to the hospital, but nothing short of compulsion would bring the chronic ambulant case into the chill efficiency of the village settlement. There were depressing facts to be discovered in all tuberculosis schemes, but there was no reason to lose heart. Both the public and the medical profession generally were beginning to take a more intelligent interest in the work. Earlier diagnosis, better accommodation for patients, better conditions of housing, pay, and food, contributed to bring some measure of success to the efforts to combat tuberculosis.

Dr. PREST (Ayrshire Sanatorium) pleaded for concentration on the early case. It was too late to wait for the discovery of tubercle bacilli in the sputum or *x*-ray demonstration of lesions in the lungs. Definite diagnosis should be made at an earlier stage by consideration of the symptoms of toxaemia. He himself placed great reliance on the rectal temperature, which was the only reliable way of taking the temperature. Unfortunately, as Dr. Macgregor had found out in Glasgow, it was extremely difficult to provide accommodation for early cases, on account of the large number of chronic ones.

Dr. CROCKETT (Bridge of Weir Sanatorium) agreed as to the importance of getting the cases early. Tuberculosis was very difficult to diagnose in its initial stages. There should be observation houses where doubtful cases could be thoroughly gone into and decided upon. Length of treatment was most important; two or three months was seldom of any service. Considerable liberty should be given to patients under treatment as an inducement to continue, but he did not believe in "week ends," as that tended to unsettle the patient.

Dr. HALLIDAY SUTHERLAND (Ministry of Pensions) repeated the dictum of Émile Sergent of Paris to the effect that no clinician, however experienced, could make a firm diagnosis of early tuberculosis by means of percussion and auscultation alone. *X* rays, which should be installed in all tuberculosis dispensaries, the subcutaneous tuberculin test, repeated examination of sputum, should all be employed, and he would add a fourth, the complement fixation test. Public health authorities should wait for the results of the gigantic experiment now being performed by the Ministry of Pensions. Through that body adequate treatment and financial assistance were being provided for all cases. If it failed nothing short of the abolition of slums and poverty would be likely to succeed.

Dr. T. M. LEGGE (Home Office) suggested a wider extension of medical supervision in the factories and workshops to detect the early cases and to keep them under supervision with regard to the physical condition of the workman, the nature of his work and the conditions under which he worked. At present, under the National Health Insurance Act, the workers streamed to the panel doctors when they became ill, but there was no return stream from the doctors into the factory to detect and remedy the illness which must ultimately fall upon the Insurance Fund.

Dr. W. H. DICKINSON (Tuberculosis Officer, Newcastle-upon-Tyne) also insisted upon early diagnosis being placed in the forefront, which meant adequate staffs and proper facilities, especially *x* rays. The administration of domiciliary treatment required improvement. Over 80 per cent. of the treatment under sanatorium benefit was given in the home. Examination of contacts should be made an essential part of every scheme, and he suggested the granting of assistance being made conditional upon the performance of this part of the work, especially in cases where there was a death from tuberculosis in the home.

Dr. C. W. CUNNINGTON (Hampstead) said he, as a general practitioner, spoke with some diffidence amongst so many experts, but he was impressed with the importance of the food factor. As the price of food went up so the tuberculosis death rate rose after it, and declined similarly. In his humble opinion the checking of tuberculosis had more to do with good feeding than all the administrative action that had been taken.

Dr. A. K. CHALMERS (M.O.H. Glasgow), President of the Section, said he also was impressed by the influence of improved food supply. It was much more important than the factor of heredity, for only one in three cases had a hereditary history. He also called attention to the anomaly of providing a pension for the tuberculous soldier, but none for the similarly afflicted civilian. Humane sentiment was against sending a person into an institution to die; that was the difficulty in dealing with the advanced case. The general impression he had obtained from the discussion was that they had now, in the matter of treatment, come to a fork in the road.

Dr. MACGREGOR, in reply, said that the majority of the speakers had simply stroked the "t's" and dotted the "i's" of the present-day schemes. Nobody could say what the next step ought to be. He agreed with Dr. Halliday Sutherland that we should wait and see what results came from the Ministry of Pensions' efforts, but he was quite convinced that segregation of the advanced cases was essential.

SECTION OF INDUSTRIAL DISEASES AND FORENSIC MEDICINE.

JOHN GLAISTER, M.D., F.R.F.P.S.Glasg., D.P.H.Camb., F.R.S.E., President.

THE IMPORTANCE OF TEACHING MEDICAL JURISPRUDENCE TO STUDENTS OF MEDICINE AND LAW.

BY

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MEDICAL jurisprudence has been defined as the application of medical knowledge to the purposes of law. It is a compulsory subject of the medical curriculum, but the scope of the teaching and the extent of the examination vary considerably. With some examining bodies the questions on medical jurisprudence form only part of a paper which is devoted to the combined subjects of medical jurisprudence and public health. In other cases separate papers are set for each subject. Entrance to the legal profession is possible without a knowledge of forensic medicine. The subject is not compulsory for those seeking to become solicitors or reading for the English Bar, but it is a compulsory subject of examination before admission to the Faculty of Advocates in Scotland.

While medicine, surgery, midwifery, and the other subjects of medical study all lend their aid to the medical jurist, scarcely any of the standard textbooks refer to points of medico-legal interest, and the practitioner who has given no consideration to medico-legal problems will find his position as a witness far from satisfactory. The physician and surgeon are concerned with the healing of the sick, but the medical jurist must view disease, accident, and death from a different standpoint and be prepared to assist the law in arriving at a just decision. The questions which have to be answered in the witness-box are often such as have received no attention during clinical practice, and no practising member of the medical profession is exempt from being called as a witness in any of the numerous cases, civil and criminal, in which medical evidence is indispensable.

To the lawyer engaged on a case involving medical questions the advantage of a knowledge of medical jurisprudence is obvious,

as he can hardly be expected to understand medical science by intuition. Much useless controversy would be avoided if the lawyer and the doctor had each some knowledge of the subject and function of the other.

It is interesting to note that discussion of medico-legal questions is not common in the various professional societies. The Medico-Legal Society, which holds its meetings in London, is the only one which devotes itself entirely to such topics. Scotland, with its different laws and legal procedure, has no such society.

The importance to the medical practitioner of a knowledge of the statutes which affect him in the practice of his profession is too evident to require discussion. Questions of registration, professional privilege, and professional secrecy, the functions of the General Medical Council, the obligations imposed regarding death certification, and similar matters are essential subjects in any course of medical jurisprudence.

Clear thinking is essential for both lawyer and doctor, and is impossible on medico-legal subjects unless these have been studied and their legal and medical aspects understood. While the doctor should understand the precision that is required by law, it is equally important that the lawyer should appreciate the limitations of medical evidence. Failure to recognize these principles is one of the reasons why medical evidence is sometimes regarded as unsatisfactory.

It is often extremely important to fix the time at which a person died and thereby associate an accused person with the commission of a murder. To do this with accuracy is beyond the power of science, yet how often does one find the medical witness pressed to state that death must have taken place at least a given number of hours before the time of his examination. Suppose he says twenty-four hours: a well-informed cross-examiner would certainly want to know what difference there would have been in the signs if the person had only been dead for twenty-two hours. It is, however, within the ability of the medical examiner to state that the signs found on a body are under the circumstances consistent with death having taken place within a specified period. That is all the help medical science can afford and the only opinion the court has a right to expect.

It is not uncommon for counsel, particularly defending counsel, to ask a general question and to utilize a favourable answer in his pleading. The results obtained from an average can never be applied to a particular case, and this line of examination defeats the object of medical evidence, which is to place before the court, regarding a technical matter, the truth, the whole truth, and nothing but the truth.

Sexual offences afford excellent examples of the need for minute observation, accuracy in describing the conditions found, and clear thinking in arriving at conclusions. In such cases the punishment meted out to the guilty can scarcely be too severe, but from the nature of the case the jury are often biased against the prisoner, and loose medical evidence may help to cause a miscarriage of justice. During the course of a trial for rape a medical witness stated that the hymen had been ruptured and that complete connexion had taken place. Neither the examination-in-chief nor the cross-examination elicited any information regarding the presence of a fresh tear; nor was the question of blood about the parts discussed, and this in spite of the fact that the girl was aged about 10 and her alleged assailant of adult age. In another case the witness thought the girl had been tampered with because the entrance to the vagina was somewhat lax. Truly a laxness of description hard to beat. In charges of rape undue importance is often given to the presence of seminal stains on the clothing of the accused. The possibility of their having been produced during legitimate sexual intercourse should always be placed clearly before the jury. In cases of alleged indecent assault on young girls marks of violence are, in the experience of the writer, only occasionally found. This can be accounted for by the nature of the interference, and the absence of positive medical evidence does not mean that the child has not been subjected to indecent practices. Clinical evidence of venereal disease should always be confirmed by bacteriological tests. In these cases consideration should also be given to the factor of time—namely, the period which has elapsed between the alleged assault and the onset of symptoms. The presence of similar disease in the accused does not prove that he communicated it but merely that he was capable of doing so.

Cases involving compensation for injury bring doctor and lawyer into contact more frequently than any other type of case, and it is here, even more than in criminal work, that the lawyer tends to regard the medical expert of the opposite side as a hired partisan. Too much has probably been made of the differences of opinion of medical men in these cases. It must be granted that doctors may honestly differ, also that even well-informed doctors may make mistakes; lawyers do both. Fashion at present tends to regard all claimants for damages as malingerers, or at least guilty of exaggerating their symptoms, and accuses the medical witnesses, particularly the much maligned general practitioner, of bolstering up a questionable case. It is doubtful if the evidence for the insurance company can justly be claimed to be less partisan than that for the claimant. Such accusations of bias are difficult to substantiate, and are probably no better founded than the popular belief that insurance companies are always eager to make a settlement favourable to themselves but unjust to the injured. The reports presented by the different medical witnesses are often substantially the same and the alleged difference of opinion only becomes acute on cross-examination, as the lawyers emphasize the points favourable to their respective clients. The meaning of the phrase "fit for work" is a common stumbling-block. When the pursuer pleads that he is unfit for a particular occupation it is not unusual for the employer to bring forward as a witness a workman suffering from a similar disability and employed on the work in question—cynics would say *for* the work in question. Viewed scientifically this line of evidence does not carry conviction and is not infrequently an attempt to compare things which are unequal and therefore cannot be compared. Valuable evidence bearing on the average capacity for work would be got if the employers brought forward statistics showing, for each class of injury, the nature of the employment before and after the accident.

That the legal mind is often more impressed by the claim which a client has than by the nature of his injuries is well illustrated by the following case. A wooden shutter fell and struck a man while he was walking along a public street. I examined him in the police office within half an hour of the accident and found no signs of physical injury and no evidence of shock. He ceased work, and many months afterwards his case came up for trial in the Court of Session. The evidence of his own medical attendant was unfavourable to him, but a hospital physician who had seen him once testified that he was suffering from arterio-sclerosis which might have been aggravated by the accident. It was not disputed that the pursuer had been struck by the shutter, and a remark by the judge, that as liability had been admitted he could not understand why the case had been brought to trial instead of being settled out of court, apparently determined counsel for the defence not to call witnesses. It is clear that there was here no real medical proof of disability resulting from the accident. An interesting feature of the case is that I had been asked by the agent for the pursuer to give evidence for his client and had refused on the ground that I could say nothing which would be helpful to him. Our conversation ended by his remarking, "Well, he at least suffers from neurasthenia." The court awarded his neurasthenic client £200 and expenses.

Instead of allowing a man's disability to be determined by a forensic duel the assessment of injury and incapacity might, with advantage, be referred to a medical referee or board of referees having no connexion with either side, the court stating the questions to which answers were required. The provision of medical referees under the Workmen's Compensation Acts is an admission of the fact that the assessing of disability is a medical matter. It is not the fault of the medical profession that only a small proportion of cases are referred to these officials.

The criminal responsibility of the alleged insane has given rise to sharp conflict of opinion between law and medicine. The difference is due largely to failure to recognize the standpoint of the other side. A criminal act implies the existence of intention, will, and malice, and involves punishment. But if the accused is proved to have been insane at the time he committed the act he is either sent to an asylum or handed over to the care of his friends, depending on the nature of the offence. The difficulty lies in determining what constitutes insanity. According to the law of England "to establish a defence on the ground of insanity it must be clearly proved that at the time of committing the act the accused was labouring under such a defect of reason from disease of the mind as not to know the

nature and quality of the act he was doing, or, if he did know it, that he did not know that what he was doing was wrong." To the jury is left the task of deciding. This legal test of insanity arose out of the McNaughton case and is based on answers given by fourteen judges in 1843 to certain questions put to them by the House of Lords.

The idiot and the maniac may satisfy the legal test, but certainly not the majority of the certified insane. Medical men recognize that there is no infallible symptom or character which will distinguish the criminal of unsound mind from the sane criminal. It has been truly said that "the mad and the bad pass by insensible gradations the one into the other."

Not all judges have found the McNaughton decision acceptable. With regard to the man Ware, who murdered a fellow patient in an asylum, Mr. Justice Hawkins remarked:

"It would be impossible to say that Ware did not know that he had killed a man, because he said himself that he had, and it would be impossible for anyone to urge that he did not know it was wrong, for, he wanted a promise that he should not be punished, but unless one put a totally different construction on the law that would have to be proved, although no man in his senses would suppose that any jury would find Ware responsible for what he had done."

The late Lord Chief Justice Cockburn expressed himself as follows:

"I have always been strongly of opinion that, as the pathology of insanity abundantly establishes, there are forms of mental disease in which, though the patient is quite aware he is about to do wrong, the will becomes overpowered by the force of irresistible impulse; the power of self-control, when destroyed or suspended by mental disease, becomes, I think, an essential element of responsibility."

In Scotland, as long ago as 1863, Lord Justice Clerk Inglis told the jury that if they were satisfied that a person charged with murder, as was the prisoner, was the victim of insane delusions at the time of commission they had no need to inquire whether he knew what was right from what was wrong or whether he knew what was murder in the eyes of the law, or what was a punishable act. The state of the law is clearly unsatisfactory. The jury are swayed by many considerations and no one can tell what their verdict may be in a particular case. There is always the danger that the merely vicious may escape punishment while the mentally unsound may be sent to imprisonment or even to the scaffold. Mere recriminations will not cause the difficulties to disappear, and it is the duty of the medical and legal professions to assist each other in reaching a satisfactory conclusion. The fact that the plea of insanity usually succeeds where epilepsy can be proved shows the appeal that is made to both legal and lay minds where something is brought forward which can be easily apprehended and appears to indicate that the interpretation of the term "insanity" will become more liberal as the nature of unsoundness of mind becomes better understood.

It is a presumption of law that a medical man can answer any question of a medical nature. A coroner may call on the nearest practitioner to make a *post-mortem* examination, though such practitioner may be far from familiar with pathological changes and may not even have been present at a *post-mortem* examination since his student days. Or a doctor may be required to give evidence regarding the only case of homicidal wounding he has met with during many years of practice. The opportunities available of becoming acquainted with the practical aspects of forensic medicine are therefore of considerable importance. Lectures must be largely relied upon but should be illustrated by photographs, lantern slides, microscopic preparations, museum specimens, and demonstrations of the methods of testing blood and seminal stains. Sometimes a small amount of practical toxicology is included, but it is doubtful if it is worth while teaching the analytical side of the subject, as the time available is not sufficient to make the teaching of practical value. The symptoms, treatment, and *post-mortem* appearances of the commoner poisons should be taught, and also the method of making a *post-mortem* examination in a case of suspected poisoning. It would be an advantage if some definite provision were made for clinical teaching in connexion with cases of poisoning. These cases when admitted to hospital may pass to any of the medical wards and thus the study of poisoning in the living is to a large extent lost as the students are scattered throughout the various clinics. Where a medical school is attached to a hospital it would be an advantage if all such cases were admitted to the same ward and if the lecturer on medical jurisprudence was given the privilege of demonstrating them to his class.

The chief clinical material of the medical jurist is the dead body, but the utilization of this for teaching purposes is beset with difficulties, and safeguards are necessary before a class of students can be introduced to a necropsy made for legal purposes. Nevertheless, all will agree that the student should be brought into contact with realities as much as possible. More frequent *post-mortem* examinations are greatly to be desired. Where there is any likelihood of a criminal charge being made a dissection of the body is always carried out, but this is not done in many cases of accident, suicide, and sudden death. The great majority of cases of poisoning in this country are accidental or suicidal, and if few *post-mortem* examinations are made, where do the authorities expect to find their experts when the occasional case of homicidal poisoning arises? There are many cases of sudden death where the probable cause is apparent after ordinary inquiry and where a necropsy is unnecessary. In those where there is doubt regarding the underlying pathological cause a *post-mortem* examination should always be made. Had one been made on Chapman's first victim antimony poisoning would probably have been discovered, and there would have been no subsequent victims. In cases of accident the apparent cause of death is not always the real cause, which can only be definitely discovered after dissection.

Unless a *post-mortem* examination has been made the verdict "Found drowned" is unjustified and consigns a body to the grave with the true cause of death undetermined. The excessive infantile mortality among illegitimate children as compared with those born in wedlock indicates the need for more thorough investigation. Owing to the difficulty of proving criminal neglect very few prosecutions would be likely to result, but the information of the true causes of death would be of the greatest value. With more frequent *post-mortem* examinations, cases of accident, suicide, and others not likely to involve criminal proceedings could be used for teaching purposes and medical evidence would be correspondingly improved.

The creation of a Central Institute of Medical Jurisprudence has sometimes been advocated. Such an institution would be useful in providing for the investigation of matters of special importance and for the training of a body of men specially skilled in the problems of legal medicine, but the necessity for teaching medical jurisprudence to students of medicine and law would still remain.

DISCUSSION.

Sir W. H. WILLCOX considered that the teaching of forensic medicine in the medical schools and universities at the present day required serious attention. The amount of time and thought which the medical student paid to forensic medicine was largely determined by the examination test which he must satisfy before qualification. There could be no question but that there had been a great deterioration in the requirements of the examining boards in the subject during the past fifteen or twenty years, and a corresponding diminution in the time and attention which the medical student devoted to it. For example, at the University of London there was formerly a separate paper on the subject of forensic medicine, a practical examination of two hours in the laboratory, and an oral examination. About fifteen years ago the examination was entirely altered and replaced by a joint paper in forensic medicine and public health, with a joint oral examination, the practical examination being abolished. Reduction in the scope of an examination inevitably led to deficient study of the subject of examination, and it was to be feared that in many of the qualifying examinations in medicine the test applied to the candidate's knowledge of forensic medicine had become more or less of a formality. The inevitable result had been that too often medical students had become qualified with a knowledge of forensic medicine quite inadequate for the practical application of the subject when called upon to give evidence in a case or assist in a medico-legal investigation. There were many indications that the legal profession was beginning to realize the increasing importance of the subject in the legal curriculum and to the practising lawyer. Dr. Spilsbury had recently given to the legal profession a course of lectures on forensic medicine of which high appreciation had been expressed at the discussion at the Medico-Legal Society. He considered it most important that the practice of forensic medicine should be centralized more than it had been. In England little centralization existed, but in Scotland medico-legal work was more centralized. Centralization would ensure the

pathological investigations being carried out by experts. It would lead to more accurate work, would promote and facilitate research and the more extensive publication of new observations. It could not be too strongly insisted upon that *post-mortem* examinations should wherever possible be made by pathological experts who were constantly engaged in the work.

Mr. J. Drummond Strathern (Procurator-Fiscal, County of Lanarkshire) took part in the discussion, on the invitation of the Section. He said that it was important that the medical practitioner should have a clear appreciation of what the law required of him in the ordinary walks of his professional vocation. The conditions found on the most casual or incidental examination might prove of very great consequence in determining a question which might subsequently arise. It was no doubt true that lawyers were inclined to expect too exact knowledge from medical witnesses, and it might be that lawyers failed to appreciate the limitations of medical science. On the other hand, it frequently happened that medical men were most unsatisfactory as witnesses, by reason of the fact that they did not appreciate the importance of a point, even when it depended for its statement on the result of their own observations. Two or more medical witnesses examining the same condition at or about the same time frequently differed materially on the facts; but in the realm of opinion based upon the same observed facts, opinions frequently differed widely, especially so when pressed under expert cross-examination. He accordingly thought that, in so far as medical jurisprudence was taught to medical students, there should be included in it some at least of the elementary principles of law, particularly those of evidence. Where a malingerer recovered compensation, in nine cases out of ten his case was supported by medical opinion which was apparently reliable, and if lawyers did err their blunder consisted merely in this, that they accepted the considered opinion of the wrong set of medical witnesses. Questions of insanity were questions of fact *plus* medical opinion. It could not be suggested that medical opinion on this matter had not varied from time to time, and in these days it was very difficult to obtain clear evidence on many cases of alleged insanity. Dr. Allison had suggested referring the assessing of disability to a medical referee or board of referees. That, in his (Mr. Strathern's) view, should not be encouraged, as it was inconsistent with the spirit of our law. There was great justification for the extension of the practice of having medical assessors when questions of that kind were under consideration. The fact that very few cases under the Workmen's Compensation Acts were referred to medical referees was the best evidence that such procedure did not command public confidence to the same degree as a court.

Dr. Godfrey Carter emphasized the importance of more consideration being given to the study of forensic medicine by all medical graduates. He advocated that in all large cities the posts of divisional surgeons to the police should be abolished and the duties placed in the hands of one man. This official would devote most of his time to that work, and the appointment should carry with it the lectureship in forensic medicine where that post existed. He urged that students should be given permission to witness *post-mortem* examinations made at the public mortuary in cases presenting a possible medico-legal aspect, unless secrecy was necessary, and that these students should afterwards attend the local courts to hear the evidence and particularly to study the giving of medical testimony.

Sir Thomas Oliver said he was glad to learn from Professor Carter that arrangements were now being made in Sheffield whereby cases coming under the head of medical jurisprudence were to be dealt with by the professor of that subject in the university. This had been the case in Scotland for many years, for between the Crown and the university professors of forensic medicine there had always been, in criminal matters, the closest connexion. Sir William Willcox had stated that his colleague, Dr. Spilsbury, had in London given lectures on some of the medical aspects of forensic medicine with great acceptance to lawyers. He himself would like to see similar sets of lectures on the legal aspect of forensic medicine to medical men. There was only one other point to which he would refer—namely, Dr. Allison's allusion in his remarks under the Workmen's Compensation Acts to men partially recovered, "fit for work." The question of "light work" was always a difficulty, for if men who were partially recovered were allowed to do light work the trade unions interfered and prevented these men doing light work and receiving money from compensation or other sources.

Dr. Allison, in reply, emphasized the fact that in cases under the Workmen's Compensation Acts he did not advise that the function of the court should be entirely abolished, but merely that the medical aspect of the case, the assessing of the degree of a man's disability, should be left to a medical referee or board of referees independent of both plaintiff and defendant. This mode of assessing disability was practised with regard to those who had served during the war, and appeared to meet with general acceptance. He also thought that the small number of cases referred to medical referees was not to be accounted for by any want of confidence in the fairness of these officials, but by the fact that both sides had to agree to the reference. Lawyers had frequently admitted that when the "other side" desired a reference to a medical referee they invariably opposed it because they knew that their opponents' case must be good, and they preferred to take their chance in open court.

DANGERS TO HEALTH ARISING FROM THE USE OF INDUSTRIAL PREPARATIONS OF ARSENIC.

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Industrial preparations of arsenic are largely used at the present time, and numerous instances of poisoning by them have been reported during the last few years. The types of poisoning to which they may give rise are accidental and criminal. Thus, either acute or subacute arsenical poisoning may occur, and this will be either of an accidental, suicidal, or homicidal type, or chronic arsenical poisoning may result, usually of an accidental type.

It cannot be doubted but that there has been a large increase in the number of cases of poisoning from industrial preparations of arsenic since 1908, and it appears certain that the ease with which very poisonous preparations of arsenic can be obtained for agricultural or horticultural purposes has been mainly responsible for this large increase.

The Poisons and Pharmacy Act of 1908 removed many of the restrictions with regard to the sale of arsenical preparations, and there can be no doubt but that, as a result of the increased facilities afforded by that Act for the sale of industrial preparations of arsenic, the public has been exposed to increased dangers from arsenical poisoning. It appears that the time has come when the mode of sale of these preparations should be carefully reconsidered with a view to the safeguarding of the public against risks of accidental or criminal poisoning. Reference will be made to this aspect of the subject later.

Industrial Preparations of Arsenic.

Arsenious oxide (As_4O_6), often called arsenious acid or white arsenic, is the most important compound of arsenic for industrial purposes, and forms the basis of most of the industrial preparations. It is a powerful poison, two grains being a possible fatal dose. It is a white, inodorous, almost tasteless powder, and so may be taken in food or drink without any suspicion arising from alteration in taste, smell, or colour. It has on various occasions been used in the preparation of food in mistake for baking powder, sugar, salt, cream of tartar, flour, and meal. It can be bought in any quantity from pharmacists, or from persons licensed to sell it. If sold in quantities of less than 10 lb. it must be coloured with at least one-sixteenth its weight of soot or one-thirty-second its weight of indigo. The evidence of recent notable trials shows that this rule is not always followed (Armstrong case). If sold in a single quantity of over 10 lb. it is not necessary for the arsenic to be coloured if its usefulness would thereby be impaired. The provisions of the Poisons Act must of course be complied with, and the sale duly recorded in the poisons register.

An easily available source of white arsenic which is often forgotten is the chemical laboratory. The poison can be obtained in any quantity from wholesale firms for laboratory purposes without any restriction as regards its sale. Every chemical laboratory possesses large quantities of white arsenic easily accessible to anyone visiting or working in it.

When arsenious oxide is used for industrial purposes it is frequently used in combination with an alkali such as caustic soda or sodium carbonate, when the very soluble sodium arsenite is produced.

Examples of its Industrial Preparations.

These include weed killers, which may be in the liquid or solid form. Liquid weed killers are strong solutions of sodium arsenite, and may contain from 14 to 40 per cent. of arsenious oxide. The solution is usually coloured by the addition of an aniline dye such as fluorescine, though during the war it was sold uncoloured. There does not appear to be any legal requirement to colour the liquid preparations. Solid weed killers are on the market and are sold in tins as a fine powder, usually coloured and containing a high percentage of arsenic. There would appear to be a legal requirement to colour this preparation. An example of the solid weed killer is "Eureka weed killer," which was mentioned in the Greenwood case. A sample was found by Mr. J. Webster to contain 60 per cent. of arsenious acid, and to be coloured by phenolphthalein. The powder was very soluble in water, and formed a pinkish-red solution which was decolorized by acids.

Arsenical weed killers are most poisonous, and not only have often given rise to accidental acute poisoning, but there is reason to believe that they have been used for criminal purposes on many occasions. An example of several cases of accidental poisoning due to liquid weed killer occurred at Haslemere in April, 1920, when a sack of sugar absorbed a quantity of liquid weed killer from a leaky tin placed beside it during transit in a railway carriage. The consumption of the contaminated sugar gave rise to an outbreak of acute arsenical poisoning. About sixty cases occurred, but no deaths ensued. In the case of Rex *v.* Bingham (1911) three fatal cases of arsenical poisoning were the subject of inquiry, and these cases were undoubtedly due to poisoning by liquid weed killer. In May, 1921, an inquest was held on a woman named Hanktelow at Beckenham, where death was found to be due to acute arsenical poisoning. In this case the source of the arsenic appeared to be Eureka weed killer. In the recent Greenwood case (1920) and the Armstrong case (1921) both liquid and solid weed killers were the subject of careful investigation as regards the origin of the arsenic found in the bodies of the deceased persons.

Arsenical Wood Preservatives.

Preparations of this type are on the market and consist of solutions of sodium arsenite which are not coloured. In 1920 I investigated an interesting example of the possible dangers of arsenical poisoning from the use of these preparations. An immense wooden hut in which 2,000 girls were employed became infested with bugs, and in order to destroy them the interior of the hut was sprayed with a well-known wood preservative, and it was stated that the men who did the spraying suffered from "sores on the hands." The undiluted preparation was reported to contain 32.1 per cent. of arsenic. A month after the treatment of the interior of the hut a white incrustation was observed on the surface of the wood, and this led to suspicion and an examination of its nature. A portion of the white deposit was scraped off and was found on analysis to contain 61 per cent. of arsenious oxide. Dust from near the top of the roof of the hut contained 11.5 per cent. of arsenious oxide, and dust from a file rack contained 3.6 per cent. of arsenious oxide. The air of the hut at the level of the working tables contained an appreciable amount of arsenic (0.07 mg. per 100 cubic feet). It was obvious that there was great danger from arsenical poisoning to those working in the hut, and continued working under such conditions would be certain to be followed by an outbreak of arsenical poisoning. Prompt measures were taken for dealing with the arsenical deposit on the wood. Several washings of the whole interior with a warm solution of sodium carbonate followed by several washings with warm water were efficient in the removal of the sodium arsenite deposited on the surface of the wood. After this treatment it was found that the contamination of the air and dust of the hut with arsenic ceased, and it is interesting to record that not a single case of arsenical poisoning occurred amongst the occupants of the hut, and that their work did not have to be stopped while the cleansing processes were being carried out.

Careful statistics of illnesses which might have been due to chronic arsenical poisoning, such as gastritis, skin diseases, diarrhoea, neuritis, etc., were kept during the whole period, and medical examinations were carried out, but no instance of arsenical poisoning was discovered.

Arsenical Sheep Dips.

These are either solid or liquid preparations of a mixture of arsenious oxide and sodium carbonate or caustic soda; sometimes they contain sulphur in addition. The undiluted preparations contain a high percentage of arsenic, and numerous cases of accidental and criminal poisoning have occurred from them. The same risks apply as with weed killers. There is risk of chronic arsenical poisoning, such as arsenical skin rashes, to those who carry out the sheep-dipping process.

Fly Papers and Fly-killing Solutions.

Fly papers are prepared by soaking bibulous paper in a solution of sodium arsenite, to which is sometimes added infusion of quassia. Fly papers usually contain from 3 to 7 grains of arsenious oxide per sheet. In the Seddon case analyses were made of fly papers from five different manufacturers, and percentages varying from 3.8 to 6.6 grains per paper were found in the different samples.

Sodium arsenite in solution, mixed with sugar or treacle, is used for moistening canvas sheets or screens in order to kill flies. This method was found of great service to the sanitary departments in the war.

An instance of accidental poisoning from sodium arsenite came to my notice during the war. In 1916 a cask of sodium arsenite intended for purposes of fly destruction lost its label, and some of the material was added to drinking water in mistake for alum, the latter being necessary for the clarification of the turbid water, which was the only kind available for drinking purposes. The sodium arsenite had the effect of clarifying the water, but those who drank it suffered from symptoms of acute arsenical poisoning. Fortunately the symptoms were at once recognized and the supply of contaminated water stopped, so that no fatal case of poisoning occurred.

On September 16th, 1916, I saw a very severe case of arsenical neuritis in a soldier who had been on duty at the drinking water station, and on August 20th, 1916, had drunk freely of the contaminated water. This man had a rapid pulse (112) with some cyanosis. There was marked wasting of the muscles of the hands, feet, forearms, and legs. There was peeling of the skin of the hands and feet and some thickening of the skin of the palms and soles. The conjunctivae were also injected. He had suffered from severe diarrhoea and vomiting on August 20th and 21st, 1916.

The case is of interest and is unusual since it shows the *rapid development* of severe arsenical neuritis and skin lesions following the taking of sodium arsenite in solution over a period of a few hours only.

Preparations of Arsenic.

Arsenical powders, pastes, and liquids for destroying animals and insects are extensively used. The active principle of these is arsenious oxide. Thus "arsenic rat paste" is a mixture of arsenious oxide, breadcrumbs, lampblack, and glycerin. Arsenical rat powders are made with a mixture of arsenious oxide and flour, to which is sometimes added strychnine and barium carbonate. Arsenical mouse powders contain white arsenic, oatmeal, or flour, to which sugar or powdered cheese is added. Sometimes these contain strychnine in addition to arsenic. "Liquid arsenical ant destroyer" is a mixture of arsenious oxide, sugar, glucose, and water; and "arsenical ant paste" is a mixture of arsenious oxide, sugar, glucose, and flour.

Arsenical soaps and pastes, the active constituent of which is arsenious oxide, are used by taxidermists in the preservation of skins. Solutions of arsenic at one time had a reputation as cosmetics, and in the Maybrick trial this use was alleged as an explanation of the possession of arsenic by the accused. Arsenical preparations are not at present used for external application to the skin.

Veterinary Uses.

Arsenious oxide has been used by grooms and horse dealers for internal administration to horses in the belief that it improves the appearance of the coat. It is scarcely necessary to add that the unskilled use of this powerful drug is frequently attended by disastrous results to the unfortunate animals.

Fruit Tree Sprays.

Arsenical preparations are most extensively used at the present time for spraying fruit trees in order to destroy harmful insects. Arsenious oxide and sodium arsenite are too destructive to the foliage of the trees to be of value. Insoluble preparations of arsenic, such as lead arsenate or calcium arsenite, are generally used, the liquid consisting of

a fine suspension in water of the active substance. The combination of arsenic and copper, as exists in the preparation known as "Paris green" or "Schweinfurth green," is of especial value for fruit-tree spraying, since it combines the insecticide properties of arsenic with the fungus-destroying properties of copper salts.

Perhaps the arsenical spraying liquid in most common use at the present time is lead arsenate. It is prepared by mixing a solution of lead acetate with a solution of sodium arsenate in the required proportions, and the fine suspension of the insoluble lead arsenate is used as a spray for fruit trees. The lead arsenate spray is applied by means of a spraying engine to the trees in the spring and early summer. A man using a spraying engine will be engaged in this occupation for several weeks, and in the process it is impossible for him to avoid the inhalation of the spray and to avoid its contact with his skin. Spraying is done before the leaves come out, and before the bloom comes, and also after the petals have fallen from the bloom. I have reason to believe that poisoning from lead arsenate fruit-tree sprays is fairly common in districts where this method of treatment is in use. Two interesting cases of poisoning from fruit-tree sprays have been under my care where severe illness, and in one case a fatal result, occurred.

CASE I.

F. W., a man, aged 40, was first seen by me on November 6th, 1919. He had lived in a fruit-growing district in the East of England and had followed the occupation of market gardener for many years. He had used in the spring of every year a spray for his fruit trees containing lead arsenate. For the last seven years he had been troubled with an erythematous rash on the hands and face. In April, 1919, the skin eruption became worse and was accompanied by marked swelling of the face and eyelids. In 1913 he was operated on for appendicitis, but previously had enjoyed good health. On November 6th, 1919, I found a marked erythema of the dorsum and palms of the hands and some thickening of the nails and tenderness of the finger-tips, and erythema and swelling were present on the face and neck. The patient stated that this condition had been present since April, 1919. On the face and neck and ears some exfoliation was present and also patches of brown pigmentation.

My colleague, Dr. Graham Little, saw this patient with me in November, 1919, and showed the case at the Dermatological Section of the Royal Society of Medicine in that month. On November 6th the urine was of specific gravity 1014, albumin was present in considerable amount (1/10 on boiling), and epithelial and granular casts were found. On November 27th the urine was found by Mr. J. Webster to contain arsenic in amount 1/200 mg. per 100 c.cm., and the hair contained a considerable proportion of arsenic, 2.8 mg. per 100 grams.

On March 3rd, 1920, in spite of the utmost precautions to avoid any contact with arsenical sprays, the urine was found to contain traces of arsenic, 1/500 mg. in 100 c.cm. In the middle of March, 1920, the patient came to reside in London for a few weeks so as to be away from any possible absorption of arsenic. On March 29th the urine still contained 1/20 albumin on boiling, but was now free from arsenic. On April 6th there was considerable improvement in health; the urine was free from albumin, and contained no arsenic. The patient returned home in April, 1920, and soon became worse.

On July 20th he was admitted to St. Mary's Hospital under my care. At this time the skin eruption had become altered, there being marked swelling of the face, eyelids, and skin around the ears, with brown discoloration and desquamation. The axillae had also become involved, and the affected skin in this region and on the face and neck showed a commencing vesicular eruption with sero-purulent discharge. There was also a discharge from each ear, due to involvement of the skin of the external auditory meatus. The skin of the lower part of the back showed desquamation and brownish pigmentation. The hands on the dorsal and palmar surfaces were red and painful, and the skin showed desquamation. Dilatation of the heart was present, and the urine contained albumin. The patient only remained in hospital for four days, and returned home at his own request. His condition became gradually worse, and he died on September 22nd, 1920.

I have no doubt that the illness of this patient was due to chronic arsenical poisoning caused by absorption of lead arsenate from the spraying preparations with which he had been in contact for years. The temporary disappearance of albuminuria in April, 1920, when there had been freedom from possible absorption of arsenic for a few weeks, is characteristic of arsenical albuminuria. It is probable also that the marked pathological affection of the kidneys was partly contributed to by the lead present in the arsenical spray.

CASE II.

A man, aged 44, a working fruit grower, who had used lead arsenate sprays for several years, was first seen by me on December 11th, 1919. He gave a history of epigastric pain and nausea since August, 1919. In October, 1919, attacks of running of saliva from the mouth occurred. These attacks occurred about once a week, and lasted from twelve to fifteen hours. During an attack the patient would discharge from 4 to 7 pints of salivary excretion. On December 11th, 1919, the urine was analysed by Mr. John Webster and found to contain a considerable trace of arsenic, 1/40 mg. in 100 c.cm.

On February 13th, 1920, a specimen of urine was again examined and found to contain 1/300 mg. of arsenic in 100 c.cm. The salivary excretion passed at this time contained no arsenic. On February 25th the urine still contained arsenic, in amount 1/600 mg. per 100 c.cm. On June 4th the urine was again examined and was found to contain a considerable amount of arsenic, 1/50 mg. per 100 c.cm. This patient had no albuminuria or skin rashes, and beyond the gastric symptoms and paroxysmal hyperptyalism showed no symptoms of chronic arsenical poisoning. I have no doubt that the paroxysmal attacks of hyperptyalism were due to chronic arsenical poisoning, but I do not know of any previously recorded cases.

Calcium arsenite is made by boiling a mixture of water, arsenious oxide, and quicklime together; the suspension of the calcium arsenite produced, when appropriately diluted, has been found to be an efficient spraying liquid for fruit trees.

London purple is a coloured arsenical residue obtained in dyeworks; when mixed with lime and water it forms an effective spraying liquid which owes its efficiency to the calcium arsenite present. *Paris purple* is a similar preparation.

Scheele's green (copper arsenite) when mixed with water has been used for fruit-tree spraying. Since it is destructive to the foliage its use has been almost abandoned.

Paris green, also known as Schweinfurth green, emerald green, mitis green, or French green, is copper aceto-arsenite. It is prepared by mixing boiling solutions of arsenious oxide and copper acetate, when the Paris green is precipitated as a fine green powder which is practically insoluble in water. The suspension of this powder has been extensively used for fruit-tree spraying. Owing to its insolubility it is not destructive to foliage, and by virtue of the arsenic and copper present it has both insecticide and fungus-destroying properties.

Preparations Formerly Used.

Arsenical pigments such as Scheele's green, Paris green, and the sulphides of arsenic were at one time much used for colouring wall-papers, artificial flowers, etc. Owing to their poisonous properties these substances are fortunately rarely used for such properties at the present time.

Arsenic tri-sulphide was at one time used as a depilatory, but since certain non-poisonous mixtures are more efficacious its use for such purposes has been abandoned.

Metallic arsenic powder known as "cobalt" was at one time used for killing flies. Its virtues were due to the presence of the arsenious oxide produced by oxidation in the air, and the substance often gave rise to accidental or criminal poisoning. Its use has been abandoned in this country for many years.

Arsenious oxide and other arsenical compounds are used in many commercial manufacturing processes other than those mentioned, and in such uses they may give rise to arsenical poisoning in the workers. The consideration of these risks would be outside the scope of this paper.

Arseniuretted Hydrogen Poisoning.

The dangers to health from arseniuretted hydrogen poisoning have been very fully dealt with by our President, Professor Glaister, in his admirable work on the subject. Mention must also be made of the risk of poisoning by the mixture of arseniuretted hydrogen and phosphoretted hydrogen which results from the action of moisture on the preparation known as *ferro-silicon*, which is imported from Germany for the purpose of hardening steel. The very careful regulations made by the Home Office and Board of Trade regarding the precautions necessary for the transport of this substance have been most successful in removing risk of poisoning. (Vide H. Wilson Hake, *Lancet*, July 23rd, 1910.)

The Contamination in Transit of Foodstuffs with Arsenical and other Poisons.

In consequence of the occurrence of numerous cases of poisoning due to the contamination in transit of articles of food by poisonous substances such as liquid weed killer, liquid sheep dip, etc., the Ministry of Health, in April, 1919, recommended the railway companies to increase the stringency of regulations relating to the carriage of these dangerous substances. It was decided that in future these poisonous substances should only be accepted for transit when contained in iron cans or drums of between five and fifty gallons capacity, securely closed so as to prevent leakage, and on no account should they be allowed to be conveyed by rail in wooden casks. Previously to the war, regulations were in force by the railway companies which ensured the transit of poisonous

substances in separate wagons, but since the war, owing to the dearth of rolling stock, this has not been possible. On August 10th, 1920, notice was given in the *London Gazette* of a new regulation to supersede No. 14 of the regulations made under Section 2 of the Poisons Act, 1908. The new regulation was as follows:

"A poisonous substance shall not be sold except in an enclosed vessel or receptacle as received from the manufacturer, *which vessel or receptacle must be of sufficient strength to withstand rough usage, securely closed, and free from leakage*, distinctly labelled with the name of the substance and the word 'Poison,' and with the name and address of the seller, as provided by Section 17 of the Pharmacy Act, 1868, and also with a notice of the special purpose for which it has been prepared. For the purposes of this Regulation the person on whose behalf any sale is made shall be deemed to be the seller."

The Sale of Industrial Preparations of Arsenic.

By the Sale of Poisons Act, 1868, the sale of arsenical preparations used for industrial purposes was only permissible by qualified pharmacists. The Poisons and Pharmacy Act of 1908 removed many of the restrictions relating to the sale of these preparations, it being then thought that certain advantages might accrue to the public from the greater freedom for purchase, and it was not at that time realized that these advantages might be accompanied by serious and grave dangers. By Section 2 of this Act it was enacted that "poisonous substances to be used exclusively in agriculture or horticulture for the destruction of insects, fungi, or bacteria, or as sheep dips or weed killers, which are poisonous by reason of their containing arsenic, tobacco, or the alkaloids of tobacco," may be sold by persons postessing no pharmaceutical qualification, provided that they are duly licensed by a local authority, and regulations were framed which dealt with the sale of these substances under such conditions.

Fourteen years have elapsed since the passing of this Act, and the time has come when the effect of the provisions of Section 2 of the Act may be carefully considered in the light of a fairly long experience. As would be expected, no serious objection can be offered to the sale of tobacco preparations, since their smell and taste are sufficient safeguards against the risk of poisoning. In the case of arsenical preparations sold under Section 2 of the Act it must be conceded that very serious and grave dangers to the public have resulted. A large number of fatal cases of accidental and suicidal poisoning have resulted from the removal of some of the previous restrictions relating to the sale of arsenical preparations used in agriculture and horticulture, and there is reason to believe that in not a few instances these preparations have been used for criminal purposes.

Dangers to the Public.

It must be admitted that persons who have had no proper training in the uses and dangers of poisons cannot appreciate the dangers likely to occur from their use, nor can they understand the necessity for special care in the storage of such poisonous preparations. Such persons are not capable of deciding whether an arsenical preparation is likely to be used for a legitimate purpose by an intending purchaser, nor can they with the confidence of experience warn such a purchaser of the dangers from poisoning of the article which they are selling. They probably have much less knowledge on this subject than the person who is desirous of purchasing from them an arsenical preparation, and could therefore not be expected to utter any warning.

The foundation principle of the sale of poisons should be that the seller has had an adequate training, and has a sufficient knowledge of the dangerous properties of the article which he is selling—in other words, he should be a proper and competent person for such sale. This foundation principle is quite destroyed by the provisions of Section 2 of the 1908 Poisons Act.

It is a very dangerous principle to assume that poisons when packed and labelled such as "weed killers" or "sheep dips" can safely be sold and distributed like articles of ordinary merchandise. The dangers to the public from the sale of industrial preparations of arsenic have during the past fourteen years been proved to be so great that it appears to me that the time has come for the safeguarding of the public against the dangers of arsenical poisoning.

Suggested Safeguards.

The first safeguard is that the sale of arsenical preparations should be limited to properly qualified and competent persons—namely, to registered pharmacists—as sellers. A second and important safeguard would be that the sale of dangerous poisons, such as the industrial preparations of arsenic, should be limited to purchasers who obtain a licence for the possession of such dangerous articles. A tin or packet of weed killer or sheep dip is at least as dangerous a possession as a firearm, and the number of persons requiring such articles is not great. It would be little hardship to them and a very great safeguard to the public if persons requiring to use industrial preparations of arsenic were required to obtain a licence for the possession of these dangerous substances. It would be quite certain that were such an enactment made a law then very much greater care would be taken by those possessing poisonous preparations of arsenic, and the risks from arsenical poisoning would almost entirely disappear.

DISCUSSION.

Sir THOMAS OLIVER said that he was struck by the large amount of industrial arsenical poisoning which was taking place in this country. We were familiar with its frequency where arsenico-copper solutions were sprayed upon vines, and the skin eruptions on the hands of market gardeners as the result of handling soot, which we knew often contained arsenic. Sir William Willcox had drawn attention to paralysis in acute arsenical poisoning, which was rather unusual and served to remind him of a similar series of symptoms, but due to another cause, which occurred in a youth who fell while carrying a barrel of red lead. The barrel burst and he was enveloped in a cloud of red dust. Sir Thomas Oliver then alluded to the immunity to arsenic acquired by the Styrian peasantry. The Tyrolese peasantry commenced with small doses to improve their virility and found that this gave them greater respiratory powers in climbing the mountains.

The following resolution, proposed by Professor GLAISTER and seconded by Dr. RUXTON, was carried unanimously:

That the sale of arsenical preparations included under Section 2 of the 1908 Act should be limited (1) on the part of the seller to properly qualified and competent persons—namely, to registered pharmacists; and (2) on the part of the purchaser to those who had obtained a licence for the possession of such dangerous articles.

SOME FACTORS WHICH MAKE FOR EFFICIENCY AND FOR THE SOCIAL UPLIFTING OF INDUSTRY.

BY

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THE subject of "industrial efficiency" can hardly be discussed without its obverse "industrial inefficiency." There can be no industrial efficiency without healthy workpeople, and the conditions under which labour is carried on being hygienic. Men must be fit for their job, and those who are fit must be kept fit. Physical ability is the outcome of several circumstances co-operating towards a common end. There can be no dissociation of employment from home life and the manner in which leisure hours are spent. Public health has already achieved much in regard to the housing of the people, the provision of adequate supplies of drinking water and healthy surroundings, also by inspection of dairies. Public health has added to the longevity of the race; it has averted epidemic disease, diminished the death rate, and improved the chances of infantile life. Its advocates have acted upon the assumption that prevention is better than cure. What public health has accomplished industrial hygiene, its twin sister in the department of preventive medicine, is making an effort to attain. For the moment we are concerned with the individual and his employment. It is the function of industrial hygiene to see that work is carried on under the healthiest conditions possible, and that the dangers incidental to occupation are either removed or reduced to a minimum. Since work is service rendered to humanity as a whole its influence ought to be uplifting. To-day there are few trades which can be regarded as degrading, but it was not always thus—as, for example, in the early part of last century, when women, employed about coal mines, dragged like beasts of burden trucks of coal, and when men were engaged for long hours on end in the puddling of iron. I remember visiting a large ironworks in the north of Europe one evening close upon midnight. The darkness was only broken by the flare gleaming

from the numerous furnaces in which the iron was being smelted. In the lurid light thus emitted there could be seen, flitting about like demons, the workmen clad only in a tunic. There were two shifts of work—a day and a night shift, of twelve hours each. The fires were never extinguished, except when the furnaces required repairing. The men had no weekly day of rest—Sunday was the same as any other day. Only once a year, on Christmas Day, were the fires allowed to become low. The heat from the furnaces was intense, the work was hard, and as a consequence the men were old and obliged to give up work before they reached the age of 40. The company owned scores of miles of land, and when the men were no longer able to work the firm granted them gratis the use of a piece of land, part of which they could till and the other use for pasture. For a precipitated old age and corresponding physical infirmity the beneficence of the employers, considerate as it might be regarded, was after all but a poor recompense for the best years of life spent, but broken, in the service of the company, and with nothing therefore for the men to look forward to. Years of hard and unremitting toil had taken the soul out of these men and left them physical wrecks. I plead for the uplifting influence of work, and that through it the standard of mankind may be raised, also for the dignity of labour of which our Scottish poet Burns sang. Since his day methods of work have changed. The subdivision of labour and the introduction of machinery on an ever-growing scale have abolished craftsmanship, so that it is given to few men to see the finished article towards the production of which they have contributed. Work has thus been robbed of one of its incentives. However much it may be admired the artificers can take little artistic pride in an article in the completion of which machinery, and not the personality of the worker, has played the greater part. While the individuality of the worker has thus to some extent disappeared, it is for us to see that the monotony of factory labour is reduced to its lowest level. There are certain occupations which instead of infusing the worker with enthusiasm rather tend to depress and unduly fatigue him.

The fact that men and women are physically affected by the trade which they follow raises the question as to whether working men should be periodically medically examined. There are three points of view at least from which this subject may be approached: (1) the attitude of the workman concerning his rights, to which he would probably subordinate all questions concerning his health and his industrial future; (2) the attitude of the employer; and (3) the general medical aspect of the question. I do not think that the working men themselves would accept medical examination on the lines which have hitherto been proposed. If this is the case, then it would be difficult to make an examination compulsory. Men in one particular factory, however, might try it voluntarily as an experiment. This at any rate would supply us with experience for future guidance. On the other hand employers would probably raise objections on the score of expense and temporary suspension or dislocation of work. There are probably few employers who would object to an entrance medical examination of apprentices, also to the examination being repeated periodically during the years of apprenticeship, since physical or other defects might be detected, so that the youth, not yet too old, could be removed and given the opportunity of taking up other occupation. There is the feeling where a workman has passed through his apprenticeship and has undergone the periodical examinations that, even if after twenty years of service he is found to be the subject of heart disease, for example, he should be allowed to carry on, so long as the weekly returns of the factory show no signs of a decline in the man's output and no indications of failing health. The firm in the circumstances would of course accept the responsibility.

The health aspect of the periodical medical examinations also calls for consideration. Children commence factory work in this country at the age of 14 years; by the time they reach 18 they are spoken of as "young persons." There would be advantages to the youths themselves if, after completing their apprenticeship and having attained the age of 18 or 19 and they have decided to continue at a particular trade, they were medically examined and pronounced fit to remain in the employment. It may be that for the physical breakdown in health of many young persons during the past years the non-repetition of the medical examination of children after having been drafted into factory life has been to some extent responsible. The early detection of disease or of some unfitting deformity would be helpful alike to the worker and to the employer. The examination might in the case of the older employees also show whether the individual was fit for the particular work, and whether the occupation was suiting him, for men and women cannot go on working for several years in succession without some structural changes occurring in the body as indicated by a rise of blood pressure or an impairment of the action of the heart which dietetic and medicinal treatment accompanied by a respite from work might possibly remove. It would be interesting to know whether the tendency for the blood pressure to rise is greater in male than in female workers, and whether in this country the morbidity rate between the ages of 15 and 50 is higher for women than for men, since this is stated to be the case in the United States of America. The blood pressure of operatives in our own country has been dealt with by a Governmental Committee,* and a table showing the findings obtained by Pembrey and his colleagues appears in Professor Collis's book *The Health of the Industrial Worker*. A comparison is made of the blood pressure of men employed in the tin-plate trade with that of men employed in metal-grinding. Taking the average blood pressure of men as 130 mm. Hg, I give briefly the average blood pressures of men in tin-plating:

Between the ages of	20 and 24	=	151 mm. Hg.
" " "	25 and 29	=	158 "
" " "	30 and 34	=	158 "
" " "	35 and 39	=	160 "

For corresponding age periods in metal-grinders the blood pressures are 143, 152, 159, and 155. In the weaving trade both men and women are employed: the work is carried on in a heated and humid atmosphere, and as a consequence blood pressures are considerably lower:

For females of 20 to 24	= 105;	for males	=	127
For females of 25 to 29	= 100;	for males	=	118
For males only 30 to 34	..	..	=	126
For males only 35 to 39	..	..	=	106

In weavers the blood pressure is generally speaking low, and in the first decade of working life it is lower in females than in males. The data are interesting, but in view of the American experience we require further information. In male workers engaged in tin-plating and metal-grinding the gradual rise of blood pressure is in keeping partly with the advance of age and the nature of the employment.

With these facts before us and the necessity of observing the physical changes which occur in men who have followed a trade for several years, can there be any serious objection to a medical examination of men on their taking up work for the first time in a factory and a record given and kept of the results of such an examination? The men would enter upon their industrial career with a fairly accurate knowledge of their own physical condition. There are some sections of the Labour party who might not approve of this, and yet there are certain trades at the present time in which a pre-occupation examination is already required. No men, for example, are allowed to undertake caisson work without submitting to such a medical examination, and such is required, too, of men who are applicants for railway appointments, for the police service, for work in white lead factories, and also in the gold mines. A medical examination should not be a deterrent but a guide to an applicant as to the particular kind of work he should undertake, and yet I must admit that, so far as the taking on of datal labour at the factory gate is concerned, an experienced foreman is a better judge of an applicant's special fitness for the particular kind of work than a doctor can be. The foreman can at once spot the individual who is likely to do the work satisfactorily. A careful medical examiner, however, can be of assistance in occasionally detecting beneath the strong frame and the healthy appearance of the workman the existence of some serious disease, such as thoracic aneurysm or aortic regurgitation, which would unfit a man for labour involving heavy strain. Pulmonary tuberculosis also might be detected and the individual be given the opportunity of treatment. It might be objected that the medical examination, by preventing men taking up certain trades, would increase the number of the unemployed; but opposed to this would be the fact that only the fittest men

* Departmental Committee on Humidity and Ventilation in Cotton Weaving Sheds, Second Report, 1911.

would be recommended to take up the harder trades and the less physically fit sent to those which are less arduous. This may sound very well, but is it likely for one moment that labour would consent to such an assignment and distribution of applicants for work? Men are neither machines nor draught animals, nor is there the slightest reason why physical fitness should thus be penalized. Quite apart from physical fitness the personality of the worker must be considered, always remembering that his health is his capital.

I have suggested that there ought to be a re-examination of all young persons employed in factories at an age of 18 or 19—that is, after they have been working a few years. Shortly before the war I was struck by the large number of deaths of female workers between the ages of 18 and 25 which had been occurring in Germany, but on investigation I found that a similar event was taking place in this country, and at the present time it is occurring in the United States of America. It is generally held that girls develop more quickly than boys, but in the United States it has been found that a larger number of girls than boys are the subjects of serious malnutrition, the percentages being 6.5 for boys, and for girls 9.2; also that orthopaedic defects, such as curvature of the spine and other deformities, are more common among girls than boys. The high mortality rate of young female life alluded to a moment or two ago is not, as I have already indicated, confined to one country. In Vienna there was observed a rise in the mortality rate from tuberculosis in female workers between the ages of 15 and 20, believed to be the result of hard work, poor food, and factory environment. Young females working in the cotton mills of the United States are said to have a higher death rate from tuberculosis than those not similarly employed. Among the industrial policy holders of one large American society it was found that between the ages of 15 and 19 the rate of tuberculosis of the lungs among male wage-earners was 7.5 and the rate among females was 14.6 per cent. higher than the rates for the same period among the general population. The experience of the American authorities *re* the high rate of pulmonary tuberculosis among female workers in the cotton mills is not that of Dr. W. A. Daley, the medical officer for Blackburn.

It is none the less desirable, however, that during the early years of their employment in a factory young persons should be medically examined, for that this is a vulnerable period, particularly of female life, is shown by the tables of the Metropolitan Life Insurance Company of America during the last decade in the increase in the number of deaths of girls between 15 and 20 years of age, while other age periods show a decrease; also that while there has been an increase in the tuberculosis death rate amounting to 5 per cent. in adolescent girls, the mortality rate from the same cause in boys of the same age has decreased 25 per cent. There is no satisfactory explanation of this rise in the tuberculosis death rate in young women. The modern style of dress has been suggested as a cause of illness, but there is nothing to support this statement; nor can it be an aftermath of the war. Whether the physiological conditions in operation at this period of life have anything to do with it I am not prepared to say.

Should a medical examination of the workers during their factory career ever be established in this country, might then the health risks not, in some way or other, be brought within the range of life insurance so as to give to the examination an additional useful purpose? In a recent address delivered elsewhere I drew attention to "group life insurance," whereby a whole factory of workers could be insured at the rate of 6d. per head per week, so that in the event of the death of a worker from any cause the dependants of the deceased could receive £100. There are insurance companies in this country willing to take the risk. In the United States, where the scheme is in operation, it has diminished the labour turnover in the factories, and it has improved friendly relationships between employer and employed. In America it is run at the employer's expense, but there is no reason why it should not be made contributory. The Life Extension Institute of America* provides an annual health examination of its policy holders; it also arranges for a medical examination by its board of workers engaged in factories, also of persons employed in commerce. The idea is to detect disease in its earliest stages. The institute maintains that by this means it has prolonged life and extended the period of a working man's career. Each member of the institute is carefully gone over, even to the extent of an *x*-ray examination, and treatment is arranged in co-operation with the member's own doctor, to whom a medical report is forwarded. At first private medical practitioners raised objections to the scheme, but the antipathy has gradually subsided. While the scheme combines "group life" and "group health" insurance, the men and the employers sharing the expenses equally, the management of the fund is entirely in the hands of a Mutual Aid Association of the employees. The medical reports go direct to the individual workers who have been examined, and are not seen by the employers, who therefore have no information of the physical fitness or of the health of the men which could be made an excuse for disqualifying them for work. Upwards of 200,000 examinations have been made by the Life Insurance Institute in ten years, during which many persons believed to be quite healthy were found to have physical defects or disease capable of cure or of being benefited. In women, for example, cancer in its early stages was detected and removed, with the result that many of the women are alive to-day.

As further illustrating the importance of periodical medical examination of the workers Dr. W. B. Fisk of Chicago gives the results of the examinations during 1921 of 3,676 employees, many of whom had been over thirty years in the service of his firm. Among the 3,676 examined 1913 defects were found, of which 768 were likely to cause loss of efficiency, and, of these, 471, or 11 per cent., were incurable. Notwithstanding these figures, defective employees are not, except under special circumstances, discharged by the firm. The men are given lighter work or they are pensioned. There is much to recommend the scheme; the subject is at any rate worthy of consideration at a friendly conference of employers and employed, and of medical men who are interested in industrial hygiene.

One of the greatest stimuli to industrial efficiency is work—regular work carried on under hygienic conditions; on the other hand, as causes of industrial inefficiency we cannot overlook individual slackness, prolonged unemployment, and frequent "strikes." The apparent light-heartedness with which strikes are sometimes entered upon, and to many of us the unconvincing excuses offered for the attitude assumed by the classes concerned, amaze many thoughtful persons among the community, who, looking impartially upon the varied aspects of labour problems, have serious misgivings as to the future prosperity of the country. This is not the place to discuss the legitimacy of strikes, but the growing disinclination in these days to fulfil obligations and to recognize the dignity of service is almost certain to bring its own Nemesis of unemployment and discontent. Apart from the physical suffering which strikes impose upon families, also the depressing effects upon the men who are incidentally involved, the longer the men are away from work the flabbier become their muscles, the softer their hands, and less the desire of the men to return to work. Prolonged strikes and unemployment are therefore serious causes of industrial inefficiency.

Time will not permit of me discussing the subjects of alcohol and work, also of food and efficiency, nor the relation of industrial inefficiency to fatigue. Welfare supervision and the rendering of "first aid" have done much to humanize industry. Roughly speaking, factory output is the result of the united effort of machinery and the person who guides it. There may be a thousand machines running at one and the same time in a particular factory, and yet experience shows that although the machinery is running the while at the same speed, the output varies, even in the same room, according to the individual behind it. In other words, although inanimate machinery is driven by regulated force, the work accomplished is largely influenced by the alertness of the individual who is superintending it. However much we may admire the beauty and mathematical precision with which a machine works, man is superior to the object which his intellect has designed and by which it has been given executive form. Always repeating the same process, the running of machinery becomes monotonous, and this monotony is reflected upon the individual who superintends it. Metal, we know, when overused is liable to exhibit something akin to fatigue, and as a consequence the output may be imperfect, but in the moving frame and rolling cylinder there is no sentience. Therein lies the difference between the human body and a factory machine, and an explanation of why the nervous system of the mill

*The Survey, August 16th, 1921, *The Life Extension Institute*, by Michael M. Davis, Junr.

worker breaks down under the regular running and persistent noise of machinery. The trend of human legislation is in the direction of the humanization of industry, of lightening burdens which are oppressive, and of removing dangers which threaten or destroy life. We are marching on, taking care meanwhile not to confuse sentiment in industry with the humanizing of it, for the two are not one and the same. There is much yet to be done, but in its desire to solve problems concerning industrial hygiene labour must co-operate with factory ownership, factory management, and medical inspection, for the problems cannot be settled by sentiment, but by reason and experience, and by an impartial consideration of all the circumstances involved.

DISCUSSION.

Dr. W. SALISBURY SHARPE said he was much interested in the table in Sir Thomas Oliver's paper which showed the differences in blood pressure and presumably of heart wear in different occupations. In connexion with railway work he had found differences in these respects in different grades, but his analysis was not yet complete enough to indicate whether physical type or occupation was the predominating factor. He hoped to be able to throw light upon this point and also upon the early signs of heart wear before the usually recognized signs of defect were apparent. He was referring to active and apparently healthy men and not to sick men.

Dr. ALEXANDER SCOTT said that the medical examination of workmen depended largely on the personality of the doctor. The examination was at first looked on with suspicion as a possible danger, tending to lower wages or otherwise to injure unfit or unsuitable workmen. By interesting the workmen in the examination and explaining the advantages of early recognition of conditions requiring to be remedied he had been able to establish a happy relationship between the workmen and himself, which allowed the examinations to be carried out under agreeable conditions.

Dr. G. E. ORME said that amongst the various factors tending to increase the sickness incidence and death rate in women mill workers as compared with men were (1) changed conditions of home life, lack of parental influence and control, and lack of early domestic education; and (2) increased consumption of alcohol, especially amongst young women.

Professor GLAISTER referred to the legal relationships of employment in which there was a contract of service, written or implied, between master and workman. The employer was entitled to expect from the employee "a fair day's work for a fair day's wage," these being mutually arranged. He was of opinion that the time had arrived for medical examination of workers following upon the examination of young persons, as required by the Factory Act, and in view of the responsibility incurred under the Workmen's Compensation Act. This examination could not, he thought, be legitimately objected to by the trade unions. He held the view that occupational mortalities were not quite of the value attributed to them, in respect that the personal equation of the individual workman was swamped in the slump. He considered that important factors in the fitness for work were the conditions of home life and the personal habits of employees. He thanked Sir Thomas Oliver for the views put forward, as they afforded important subjects for consideration.

Dr. JAMES R. KERR emphasized the importance of the physical efficiency of the worker in the general efficiency of the factory as estimated by output. The incidence of scoliosis to which Sir Thomas Oliver referred probably occurred in the young female workers as a direct physical result of neglect of recreative exercise in the presence of wrong postural tendencies. The benefit of facilities for recreation in connexion with factories should be better known, and the more artificial the nature of the occupation, and particularly if it involved asymmetrical use of trunk or limb muscles, the more essential it was to have adequate and experienced medical supervision of games, physical drill, and gymnasium exercises. As regards welfare work, he was glad that Sir Thomas Oliver laid down the serious warning that the greatest care must be taken not to confuse sentiment in industry with the humanizing of it. It was of primary importance that medical opinion should direct and guide all efforts and schemes for the welfare of the factory worker. The medical examination of employees demanded the proper spirit and personality on the part of the doctor associated with frankness and fairness towards the employee in order to obtain the most beneficent results.

THE TREATMENT OF INDUSTRIAL ACCIDENTS.

BY

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FROM among the subjects which naturally fall to be discussed under the title of this paper I am forced by the exigencies of time to select only a few of the more fundamental.

In the first place, we have to bear in mind that the treatment of an industrial accident has very close interest for the many participants in its immediate and remote results; that, in fact, the victim of the accident and the attending surgeon are only the centre points round which circles of sentimental, financial, and economic interest are created. It is recognized that the appropriate setting for the entire picture can only be one in which complete harmony of purpose and mutual support exist among all those concerned.

I cannot refer here to the methods of accident prevention beyond the general statement that the first line of defence of the workman against himself and for the safety of his fellow workmen is the systematic medical examination of employees, and in this connexion to record my experience that workmen readily appreciate that the opportunity of being examined at the factory does not turn out to be the disservice to them which at first sight they may have been encouraged to believe it would be.

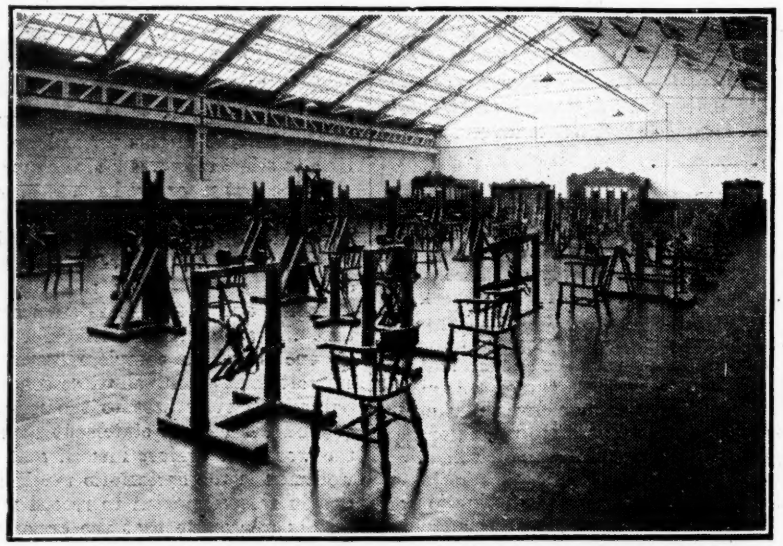
In this country we have not written so much regarding the treatment of industrial accidents and the organization of factory medical service as has been done in America. No doubt the large plants that are set down and the mushroom growths of great industrial communities round new and probably somewhat hazardous manufacturing or engineering enterprises have made it more obvious to the employer that the provision of ambulance and hospital service must be reckoned in with the cost of production. No doubt also the very fact that these medical arrangements were started there *de novo*, not grafted on to pre-existing and probably inadequate arrangements as is the case in an older country, has given our colleagues in the United States a Factory Medical Service very inclusive in its efforts and housed in first-aid rooms and works hospitals which compel our admiration. On close examination, however, it would probably be found that in our densely populated coal-mining, iron, pottery, etc., areas the arrangements for the care of accident cases are of an unsuspectedly high standard. It falls to my lot to see a very large number of accident cases from a considerable portion of industrial England, and the feeling I have is that although there is good provision for the immediate and immediately subsequent treatment of accidental injuries of all kinds, there comes a stage in the progress of the case when there is no adequate provision for the next essential procedure towards the restoration of the patient to his working capacity. In this matter of subsequent treatment I feel that we are behind France and Germany.

To come back to my opening remarks, I would repeat that it is essential for us to appreciate the far-reaching consequences which result from an accident to an employee. The employer is concerned in the loss of the man's work and output, and the community has got to bear the burden of supporting a non-producing member. The amount of the compensation payment is of subordinate importance to the loss of the man's service as a workman, a skilled artisan—that is, "a producer," whatever his job may have been. The situation thus broadly outlined has been of late years squarely faced by employers, insurance companies, and friendly societies representing the workers. These various interests are agreed that, quite apart from its humanitarian and medical aspects, adequate attention to injured operatives is an economic proposition. The weight of opinion represented is so great that arrangements on the best lines are certain to be made on a wide scale at a relatively early date. The workmen of this country are sharply alive to the fact that during the war nothing, from the moment they were wounded, was spared in the endeavour to re-establish their fitness for service. They know what hospitals mean, and their appreciation of what orthopaedic surgery has done for them

and their comrades is ever present. When wounded in the industrial conflict these men will not accept with equanimity the compensation payment of 35s. a week with inadequate or haphazard after-treatment. Their desire will soon become a demand which in the last resort the State dare not disregard.

Organized hospital treatment of accidents and disablements, even should it not be above the level of that provided for the injured German worker, as seen by me in 1912, is bound to come. Confirmatory words are found in the report of the Departmental Committee appointed to inquire into the system of compensation for injuries to workmen (Part 5, Section 2), which also states that:

"The expenses of such extra services should be provided by the employers because the need for them has been created directly by the risks of employment, and they will have a material effect in reducing the amount of monetary compensation payable under the Act."



The Hall for Mechanotherapy (lower end). These special appliances are used for helping the movements of stiff joints and the development and re-education of injured muscles. All are finely poised and capable of delicate and gradual adjustments to suit the individual cases.

Having thus disposed of the question of the cost of treatment of industrial accidents I turn to the practical treatment of the injured workman. I must leave out of consideration meantime such factors contributing to accidents as monotony of employment; overtime; the shift factor; piece work; the illumination factor; and the risk factor involved in the particular occupation itself. The teaching of first-aid methods is taken up with such enthusiasm in this country, and so many laymen are efficient in this work, that treatment on the spot and conveyance to the dressing station, the works surgery, or the doctor's surgery, are well carried out.

In cases of "shock" the time which elapses between the accident and the induction of a morphine analgesia is of vital importance, especially in younger employees, and I think it well to have at each dressing station a supply of hypodermic doses of morphine ready for immediate injection. As a practical point I find the convenience and economy of the Tubunic outfit, which has the prepared solution ready to be expressed from the flexible capsule through the needle which is fixed to it, without any delay from a rusty needle, or a broken syringe, or an insoluble tablet, etc. These capsules can be kept in an envelope sealed and initialled by the works doctor, and are used only by him or under his orders.

The supply of cottage and other local hospitals throughout industrial areas is, as a rule, very good, and the surgical lessons from the war are reflected in the procedures adopted. I am not aware, however, that the heated resuscitation chamber is sufficiently used. In every hospital liable to receive accidents some such provision should be made, and probably the most convenient is the electric quilt, which should be kept hot in readiness night and day, the resistance interposed between the main supply being used as a heater for a two-pint container of a normal saline or a sodium bicarbonate solution.

The posture of burned, scalded, lacerated, or crushed limbs should be considered from the first with a view to the ultimate function, and it will be found much easier to place the affected limb in an orthopaedically correct position at once than to wait till later. As the patient is presumably under the influence of morphine there will be less pain on movement than on the following day. In view of the brilliant results of modern orthopaedic surgery, as tested out by the difficult and numerous cases of the war, one can confidently plead for the most advanced conservatism in the treatment of injuries. On the other hand, to those who, on account of the circumstances of any case, are in perplexity as to whether they can just manage a Syme's amputation as the least mutilating result of an injury, I would say that a "below knee" is an amputation that readily lends itself to the application of a serviceable artificial limb. It requires no special ankle fitting, and therefore no conspicuous boot, as does the artificial appliance for the Syme's amputation. Incisions for drainage, etc., must of course be kept away from the bearing surface of the head of the tibia, although even when these have been made they can be accommodated for in the design of the bucket.

The Hall for Hydrotherapy: the Warm Pool. This pool, 36 ft. long by 20 ft. broad, contains warm water at 98° F., and is maintained in turbulent motion by great volumes of compressed air forced into it through orifices in long pipes lying at the sides. Patients are exercised in this water, which at the same time provides hydro-massage. Active movements of shoulder and hip joints are thereby encouraged. The limb is floating, supported by the water, and thus there is minimal resistance to its movement. This gives weak muscles a chance of exercising themselves as power returns. Certain helpless cases are wheeled down the incline into the water, which is 3 ft. 6 in. deep, and placed on lounge seats along the sides.

We may pass to what is known as the *after-treatment*. Many of the cases require movements, active and passive, possibly massage and faradic stimulation, re-education of muscle, and graduated exercises. The rate of recovery is very satisfactory and the only difficulty which arises is that many doctors do not take advantage of the treatment at as early a date as the condition of their patient would actually permit, and that time and opportunity are to some extent lost thereby. However, with the provision of the facilities one finds that the demand increases.

Most of the hospitals of this country owe their inception and continued existence to the anxiety of all thinking men to provide against the turn of Fortune's wheel. These excellent institutions

are tributes to the forethought and thrift of the worker and to the broad views of the employer. They provide an immediate haven for the sufferer. The history of these hospitals is a long and honourable one, but it is obvious that they can never supply the need for the specialized after-treatment—operative or by physiotherapy—which has been brought into great prominence and found to be of inestimable service during and since the war. The splendid recovery of our soldiers and sailors from crippling war wounds is well known, and the surgical experiences of the war have widened and advanced the range of restorative treatment. The variety and severity of factory accidents bear close comparison with those of modern warfare, and it has only to be mentioned to receive universal acquiescence that the benefits of the proven best treatments should be available for the victims of industrial injuries; and, what is more important, that there should be continuity of after-treatment and after-care. While surgeon to one of the large orthopaedic and limb-fitting centres I have simultaneously had the opportunity of applying to industrial accident cases the methods and resources of orthopaedic surgery, and for several years now we have been providing specialized treatment of the sort to which the Departmental Committee on Industrial Accidents refers. It is very satisfactory to be able to report to this Section that insurance companies, employers, the patients, and their doctors are most appreciative of this new phase of specialized surgical work.

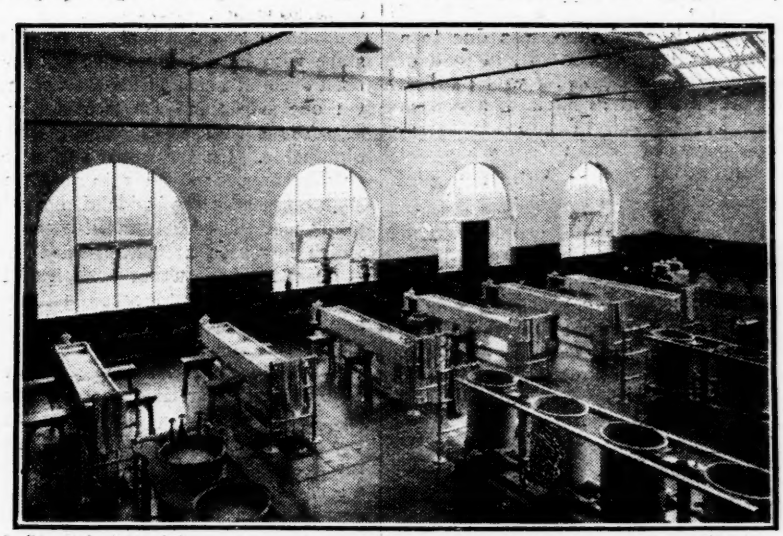
Thermotherapy: Hot Dry Air Treatment. Here are shown patients with limbs being subjected to hot dry air (250° to 300° F.). The asbestos-lined cabinets which enclose the parts under treatment are supplied with compressed air which has passed through regulated electric heaters.

It may be useful to consider the course of treatment followed in typical cases referred to me for after-treatment. The doctor referring the case, and probably also a doctor acting for the insurance company or the employers, provide reports which give preliminary information. The examination of the patient includes a detailed measurement of the range of movement of each joint, including of course metacarpo-phalangeal and inter-phalangeal joints, etc. The state of any nerve lesion, if present, is investigated. Stereoscopic *x*-ray photographs are taken, and frequently photographs and plaster casts, to serve as records for comparison later. In a certain number of cases the paralysis present is found to be due to want of proper posturing during the probably long period of previous treatment — for example, a case of fracture of the humerus presented itself with so marked a condition of drop-wrist that the musculo-spiral nerve was suspected. Appropriate splinting for three weeks resulted in some flicker of voluntary recovery, and further treatment completed the case. On the other hand, a fall of coal had severely excoriated the outer side of the upper arm but had crushed the tibia and fibula, fracturing them. The patient was up and walking about with a very serviceable leg before treatment was sought for the condition of drop-wrist which was manifest. In this case exposure of the musculo-spiral nerve discovered it to be adherent to the bone, ingrained with pieces of coal, and constricted in a dense fibrous tissue mass. Surgical interference was essential before physiotherapy could be of any avail. The recovery then followed a normal and rapid course. Fractures at the elbow likewise present themselves with marked ulnar wasting, etc., on which no amount of massage would make any impression until the nerve lesion has been dealt with. It must therefore be understood that the function of an orthopaedic hospital is not "glorified rubbing." On the contrary, the orthopaedic hospital should be a centre, available to the doctors of a wide area, for reference in difficult and tedious cases, to treat which they have neither time nor adequate opportunity. Corrective osteotomy, arthroplasty, arthrodesis, tendon transplanting, and all the surgical devices to restore limbs to usefulness must be in the armamentarium. It is obvious, therefore, that the after-treatment of industrial accidents covers a wide field in operative procedures, quite apart from the physiotherapy measures.

In contrast, one has the type of case in which fibrous tissue, the result of prolonged and profound sepsis, holds the limb or the hand in an unyielding grasp. In view of length of time it may be that shrinkage of joint capsules, ligamentous structures, etc., demand certain preliminary operations, and all manner of devices for overcoming contractures or adaptive shortenings. The end-results in such cases after prolonged and intensive physiotherapy treatment have surprised most competent observers.

Having thus examined the patient and carried out such preliminary treatment as I have just suggested where required, we shall follow him through his physiotherapy course.

[Dr. Kerr here gave a description of the physiotherapy treatment rooms and equipment at the Pilkington Special Hospital, St. Helens, probably the largest installation in this country, and showed photographs illustrating the warm pools, the multiple baths for arms and legs, the hot-air cabinets, the electro-room, the mechano-therapy room, plaster casts, etc.]



The Hydro Room: Multiple Baths for Arms and Legs. In foreground and to right are sets of baths for leg cases. Behind are multiple, "waterfall," baths for arms. Four are in action. "Contrast" foot baths are shown.

Should we seek for adjectives to characterize the details of modern orthopaedic treatment we might without offence speak of the methods as purposive, co-operative, insistent, intensive, cumulative, and of the results not merely as full of promise but even now justifying beyond cavil the adoption of the title "Orthopaedic" by hospitals of the type I have had the pleasure to describe to you.

In conclusion, the efficient treatment of industrial accidents is of vital importance to the community and to the State. The figures showing the loss in man-power and in wages and the concomitant burden on industry are at present enormous. The employer, I assert, is willing and anxious to co-operate with you because the great factor of industrial success lies in the efficiency of the worker, which means maximum output, and is well aware that scientific and controlled experiments have proved that it pays handsomely to cultivate the physiological best in the employee. The larger insurance companies also now realize

that the victim of an industrial accident is not profitably reckoned as merely a "claim" to be badgered and harassed into what is called a "settlement" by a slow process of starving out. A long and intimate acquaintance with injured workmen discloses to me that a disabled employee makes an excellent and appreciative patient. But you must not talk medical nonsense to him. Explain briefly and plainly what the situation is, and do not minimize the severity of the injury or the length of time required for recovery to be gained. From the moment of his injury he has before him a vision of the future of his dependants, and it is our privilege to give the utmost of our skill and ingenuity to his and their service. I am fortunate in having a hospital, probably pioneer, devoted to the treatment of all sorts of crippling—children and adults—but chiefly crippling resulting from industrial accidents. The acquired orthopaedic experience of our staff is now concentrated on civil problems, and the great value of the service is widely recognized by those who have the treatment of industrial accidents in their minds as one important factor towards the success of our industries in international competition.

DISCUSSION.

Dr. JOHN C. MCVAIL said that what impressed him in Dr. Kerr's interesting paper was the illustration it provided of the influence of Government policy on the prevention and treatment of industrial accidents and disease. The increase of the employer's financial responsibilities through the superimposing on common law of the Employer's Liability Act and then of the successive compensation Acts had been accompanied by a tremendous advance in the control, by means of orthopaedic surgery and otherwise, exercised over such accidents and diseases, in the direction both of prevention and of cure. Dr. Kerr's paper was an admirable exposition of the good work that was being done.

Dr. W. SALISBURY SHARPE said that cases frequently came under notice in which compensation was demanded for incapacity, the extent and duration of which was due to bad treatment and not to the initial injury, the employer being made responsible for the effects of treatment over which he had no control. He would like to know how the special hospital which Dr. Kerr represented was supported.

Dr. A. COLES said that much loss of time was due to a trivial injury becoming serious by neglect. If, instead of washing a wound immediately it happened, it was painted with iodine, much septicaemia would be avoided. If a system of partial employment for the partially disabled was encouraged, the injured person would return to work at an earlier date, to the mutual advantage of employed and employer.

Dr. KERR, in reply, agreed with Dr. McVail that a great advance in the treatment of injured workmen had been achieved by placing responsibilities on the employers. He considered it important that the first dressing applied to a wound should be a sterile one. He explained that the Pilkington Special Hospital specialized in the after-treatment of industrial accidents, and that cases were admitted on a simple payment basis, which had proved acceptable to insurance companies, employers, and private patients.

APPARATUS FOR THE ESTIMATION OF THE WORKING CAPACITY OF AN UPPER EXTREMITY.

BY

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THE civil aspect of medico-legal practice presents many difficulties, more especially that branch of this specialty which deals with the perplexities of the medical aspect of the Workmen's Compensation Act. For the purposes of awarding compensation one is frequently called upon to examine individuals who have sustained injuries to an upper extremity, and to express an opinion as to their capacity for work. In the past few years from the many cases coming under my observation in this respect there have been a considerable number who have during examination given the impression of unwillingness to demonstrate their capacity for work. After careful scrutiny and consideration of the existing tests, I came to the conclusion that perhaps the quality and character of these tests were partly to blame on account of their inaccuracy and difficulty of application.

We may now consider for a moment a method commonly employed for estimating the working capacity of the upper extremity as a whole by means of weights. The examinee is usually requested to lift weights of different sizes, and the amounts of the weights lifted are carefully noted by the examiner. Assume for the moment that the patient is a willing one, there is a strong objection to this test as described, inasmuch as it does not permit of estimating the work done by the extremity of the individual. To state that a man is able to lift a weight of 28 lb. without complaint of pain or discomfort is of course stating a useful fact in relation to the power of the extremity, but it would have much greater import if stated in terms of work actually done, which can be satisfactorily expressed in foot-pounds, because it is with the working capacity that we are chiefly concerned. Another strong objection which is apparent is that in the case of the none-too-willing patient—and there are many—he appreciates the size of the weight, and if he is astute, which is not uncommon in this class of case, he may easily read the amount of the weight engraved upon it. These factors frequently undermine any little moral courage a man may have to attempt to lift.

After careful observation of the cases so tested by me and by others, I endeavoured to overcome these objections by having a suitable and simple apparatus constructed. This construction was carried out for me by the local branch of the Surgical Manufacturing Company, Mortimer Street, London. My aims of this apparatus were:

1. To have the weight-lifting test recorded more or less automatically in terms of foot-pounds of work done by an extremity.
2. To obviate the objections already mentioned.
3. To check attempts at malingering.
4. To record uniform results.

I have arranged for this apparatus to be before you to-day, so that it can be demonstrated. For purposes of description it might be more or less accurately described as a box having the following dimensions: length 36 inches; breadth 12 inches; depth 20 inches.

It should be noted that you see this cabinet in its experimental stage with its accompanying crudeness, as many changes have been effected in its structure since it made its first appearance. On one side there are two sliding doors fitted, having such dimensions that when opened ready access to the interior is obtainable. On the upper surface of the cabinet are six holes or apertures, supplied with metal collars, through which pass six steel rods to the inside of the apparatus. At the uppermost portion of the rods is fitted a short, comfortable steel handle, which has been acetylene welded to the rod ring. This ring is formed by the upper portion of the rod itself being curved, and its object is to accommodate a finger in order to add additional security to the hand grip. The lowermost portion of the rod is hook-shaped, for the purpose of suspending the weights. Each rod measures exactly twelve inches from the base of the finger ring to the commencement of the hook. It should be noted that the finger ring can be utilized to allow the fingers to operate on the weights individually if so required for a purpose to be considered later. The rods are made of steel which has been semi-tempered in order to permit of them suspending a 56 lb. weight without straining them. At the base of the finger ring a rubber washer will be noted; the object of its presence is to eliminate noise during the operation of the weights. The weights suspended are ordinary standard weights, weighing from 1 lb. to 56 lb. Weights from 1 oz. to 1 lb. have also been supplied for testing the power of the individual fingers, and for the retoning of the intrinsic muscles of the hand. Each of the larger weights is fitted with a U-piece which is welded on to the bar of the weight; this measure prevents the hook slipping from side to side when the weight is being lifted.

The following merits are claimed for this piece of apparatus, as the results of using it for a considerable period in many cases:

1. The examinee is unable to observe the weight he is lifting; in many instances it would appear doubtful if he realizes that he is lifting an ordinary weight at all. I have been frequently

asked whether the gripping of the "black handle will give a shock."

2. Any standard weight can be fitted to the machine.

3. The order of the weights can be altered practically *ad infinitum*, thereby preventing a man becoming familiar with the order of the weights at a subsequent examination.

4. When volition is present it is foolproof against malingering.

5. The results are constant.

Each time an individual fully raises a handle with a weight suspended he performs an accurate amount of work—that is, the number of pounds raised is expressed as foot-pounds of work done, as each pound is lifted through the space of one foot.

The apparatus is applied in the following way: The examinee is requested to lift a certain handle as often as he can on which is suspended the heaviest weight which he has proved capable of lifting. The number of times the weight is fully lifted multiplied by the weight lifted gives the total work done by that upper extremity expressed in foot-pounds.

In cases of suspected malingering the test should be applied as follows: Test the claimant's ability to lift the various handles. Assume, for the purpose of example, that the man states that he is unable to lift a handle on which a 1 lb. weight is suspended; ask him to lift an ordinary 1 lb. weight from the floor; if he does so readily and without complaint of pain or discomfort malingering can be strongly suspected. In a case of this kind the best procedure is merely to open the sliding door of the cabinet and show him the 1 lb. weight which he alleged he was unable to lift. In certain circumstances it may be found excellent to make a note of the fact and not demonstrate this act of deceit to the man.

An alternative method of detecting malingering is to place two or more of the same weights in the cabinet at the same time. The man may easily raise one of these and fail to raise a duplicate one when its turn comes.

In conclusion it should be mentioned that, judging from practical results, it would appear that the apparatus should prove extremely useful for exercises which have for their object the retoning of the intrinsic muscles of the hand or the muscles of the upper extremity following injury.

In cases where men will not attempt to operate the apparatus the examiner must of course rely on the objective signs of injury and its sequelae in conjunction with the general attitude of the man, and form an approximate opinion of the efficiency of the hand for work.

THE OCCUPATION DERMATOSES OF THE PARAFFIN WORKERS OF THE SCOTTISH SHALE OIL INDUSTRY.

BY

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THE skin lesions due to contact with oily paraffin in a crude or semi-refined state may be described as conforming to the following types, of which one only or several may be found on the same individual:

1. Occupation comedones.
2. Folliculitis and follicular dermatitis.
3. Dermatitis pustulare.
4. Dermatitis papulare (erythema papulare).
5. Erythema simplex.
6. Dermatitis erythematosa.
7. Epithelioma (paraffin workers' cancer).

These, which include all forms of occupational eruptions met with in the Scottish shale oil industry, will be described under their various heads.

1. *Occupation Comedones.*

Comedones occur in parts exposed to contact with paraffin products, especially over the flexures of elbows, posterior aspects of elbows, upper aspects of shoulder-joints, and occasionally over knees. Their origin is purely mechanical, being due to obstruction of the sebaceous ducts with semi-solid paraffin substances, or to thickening of the superficial layers of the epidermis, causing obstruction of ducts. They are larger than comedones met with under ordinary conditions, more closely packed together, and confined to circumscribed areas, being most prevalent on the anterior aspects of the body and limbs. The outer layers are pigmented and hardened. The comedones are easily expressed, but if left unattended are apt to be followed by the development of sebaceous concretions of a cystic nature, which are most commonly found over the flexures of the elbows. There is not the same tendency to acne formation as under ordinary circumstances, possibly owing to the fact that the materials obstructing the ducts are sterile and practically antiseptic, and it is only after they have persisted for lengthened periods that any tendency towards acne formation is seen.

2. *Folliculitis: Perifolliculitis: Follicular Dermatitis.*

Folliculitis consists of destruction of the hairs and hair follicles as the result of a mild inflammatory reaction set up by the action of shale oils. The follicles become somewhat dilated and are filled with epithelial débris and dirt, so that they appear as closely grouped clusters of black points over the parts affected. Occasionally a slight perifolliculitis occurs, in which the inflammatory condition extends to the surrounding skin, which becomes slightly raised above the rest of the skin tissue, and which ultimately becomes somewhat indurated and thickened. The most common sites are the backs of fingers and hands, and to a less degree on the forearms, the legs around the ankles, and the dorsal aspects of toes and feet, especially on the line of the extensor tendons of toes. There is never any tendency towards suppuration or sloughing, the condition persisting as described indefinitely. The usual appearance of dryness of the hands, with clusters of black points on backs of fingers and hands, is very characteristic among paraffin workers.

3. *Dermatitis Pustulare.*

Two types have been observed:

(*a*) One in which the condition is characterized by the appearance of numerous small pustules over the anterior aspect of the body and limbs, and

(*b*) One in which the pustular eruption is due to the breaking down of the typical papule, which is the most prevalent form of occupational eruption.

(*a*) *Primary Dermatitis Pustulare.*—A widely distributed pustular dermatitis has been noted among youths beginning work in the paraffin departments. This condition appears to be due to contact with semi-refined oily paraffin, which sets up an acute irritation of superficial layers of epidermis with pus formation. The channel of entrance appears to be by the hair follicles, as generally a hair is found in the centre of each pustule. It is most probable that there is an idiosyncrasy towards the action of paraffin in some of its forms, causing one individual to be acutely affected while by far the larger proportion escapes. Pustular dermatitis readily disappears on removing the individual from his particular form of work or on taking precautions as regards cleanliness. The tops of the pustules dry and are shed as crusts, without further return.

(*b*) *Papulo-Pustule.*—These occur as small pustular elevations on the sites of papules, the suppuration taking place at the apical part of the papule. As a rule these are not numerous, and are usually seen in conjunction with a papular eruption. They are not surrounded by an inflammatory areola, and are due to the breaking down of papules, either from a staphylococcal or streptococcal infection, or to the separation of a small necrotic area from the centre of the papule, after which the papulo-pustule disappears.

4. *Papular Dermatitis (Erythema Papulare).*

This is by far the most common type of skin lesion met with among the paraffin workers of the Scottish shale oil industry, between 40 and 50 per cent. of the workers being affected. The papules are known in the trade as "paraffin plukes," and are most typical of an occupation condition both in history and distribution.

Papular dermatitis consists of an eruption of small rounded elevations of a reddish colour, varying in size from that of a small peppercorn to that of a small pea. They correspond in every way to the typical primary lesion described as a papule, being solid, superficial, rounded in shape, and containing no fluid. As a rule the tops are convex, but occasionally there is apparent a minute central depression, from which a tiny thread-like core can be expressed or removed, and which corresponds to a necrosed hair follicle or sweat duct. I have seen in a very few instances small, soft papules with tiny horny excrescences

on top, giving the appearance of diminutive cutaneous horns, such being situated on the scrotum.

The entrance of irritant to the superficial layers of the skin appears to be most commonly through the sweat ducts, but very frequently the hair follicles are involved, in which case they occupy the central position in a papule. There is as a rule no inflammatory areola around the typical papule. The papular eruption differs from other lichenoid eruptions, in that there is no itching or irritation, the papules do not tend to coalesce, and as a rule heal spontaneously. It has been frequently noted during the routine examinations of the workmen that the sites of papules vary from time to time, and that between the examinations some have healed and others have appeared in different situations. The papules may be present singly, or in twos or threes or in larger numbers until there may be a diffuse eruption of discrete papules. Between 40 and 50 per cent. of the workmen are affected with this type of eruption, and of those affected approximately 50 per cent. show not more than three or four papules, 45 per cent. have a limited extent of eruption confined to a small area, and 5 per cent. have a diffuse eruption.

The distribution of the papular eruption is very typical. In the great majority of cases it is confined to the forearms, and as a rule is most pronounced over the ulnar aspect, though it is also prevalent over the anterior and posterior aspects, around the wrists and on the backs of the hands. Less frequently a few papules are present on the shoulders, legs, and dorsal aspects of the feet. In old-standing cases they are seen over the lower thirds of the arms and around the elbow-joints, and occasionally on the anterior aspects of the body, thighs, and on the face and neck. The palms of the hands and soles of the feet are never affected. Approximately 75 per cent. of those affected have eruption on the hands and arms only, 20 per cent. have both arms and legs affected, and about 5 per cent. have some eruption on the body, as well as on the arms or legs. The most typical position in which the papular eruption is found is over the ulnar aspect of the forearms, this being the part most in contact with the paraffin in its semi-refined state. On two occasions I have seen papules on the scrotum.

The earliest appearance of papules after men begin work in paraffin sheds occurs in from ten to twelve days, and they may persist throughout the duration of employment. They disappear a few weeks after ceasing work among the semi-refined paraffin. Occasionally in old-standing cases the papules instead of healing assume a warty appearance, due to proliferation of superficial layers of epidermis, and to growth of connective tissue cells, forming scaly warts, at first soft, but gradually becoming harder and more indurated, with a covering of dry scales which are readily detached. This warty appearance is of a permanent nature. In the most chronic types of this condition of warty papule there is occasionally a tendency to increase in size, accompanied by the formation of a central necrotic area, which may separate and be followed ultimately by the disappearance of the warty growth, with atrophy of the skin tissue and the formation of a scar. These more chronic types are as a rule associated with an old-standing induration of skin, due to chronic erythematous dermatitis. As a still more advanced stage of the condition described the warty papule, instead of disappearing, grows until it assumes the characters of an epitheliomatous growth, with the usual clinical and pathological features of that condition.

5. *Erythema Simplex.*

This consists of a mild hyperaemia, in which the redness is distributed uniformly over the parts affected. The first appearance is a slight blush, followed by a greater degree of redness, which in the early stages disappears on pressure, to reappear when pressure is withdrawn. This hyperaemia is almost always limited to the forearms, which show a generalized redness, there being no "patchiness" in its appearance. In exceptional instances a slight degree has been seen on the feet. Associated with the increase in colour is a marked dryness of the skin. In the later stages there is a tendency for the erythema to become slightly purplish and to remain on pressure, the pigmentation of the skin being permanent. This condition may persist for years without alteration. In addition, there is a scaliness of the arms, in which the superficial cells of epidermis are readily rubbed off in fine scales. There is frequently seen a shiny or lustrous condition of skin, giving the arms a polished appearance. There is never at any time any tendency to moistness or exudation, and seldom are there any subjective symptoms, such as itching or irritation, along with the erythema. This type of lesion frequently exists alone without the presence of other form of occupation eruption, and is somewhat prevalent among the paraffin workers.

6. *Dermatitis Erythematosa.*

This is essentially a dermatitis venenata of a subacute or chronic type, due to the irritant action of semi-refined paraffin on the tissues of the skin prolonged over a lengthened period—for years in practically every instance. It represents a further extension of erythema, in which the congestion gradually merges into a chronic inflammation of the various layers of the epidermis and cutis vera, followed by induration, and, in the most advanced stages, by partial or complete destruction of small areas of the skin in the affected parts.

In the first stages, the lesion consists of dull red erythematous patches distributed irregularly over the anterior aspects of forearms, either broadly linear or roughly circular in shape, giving a honeycombed appearance to the skin. They are slightly raised above the surface of the skin, are very dry, and somewhat scaly. At first the condition is limited to small areas, but, as it becomes more old-standing, involves larger areas, the whole surface of the forearms being frequently affected. Associated with this erythematous condition there is usually pigmentation occurring in small patches over the parts involved. This erythematous stage may persist for long periods without further change, or healing may take place, the redness disappearing, being replaced by some induration of the superficial layers of the skin, with a characteristic dry scaliness which is practically permanent.

Frequently the erythematous dermatitis progresses so that the deeper layers of the skin are infiltrated, and as the inflammatory process subsides small patches of atrophied skin, white in colour, appear, or there may be scar formation, according to the depth of the inflammatory changes. There is frequently a tendency to the formation of small flay scaly warts, usually oval or circular in shape. In advanced cases the whole surface of the forearm appears indurated, hard, and thickened, giving a tanned leathery appearance. These warts, if injured by abrasion or mechanical damage, are apt to become irritated and undergo excessive epithelial proliferation, with subsequent growth in size.

The advanced condition of dermatitis may persist for many years or for a lifetime, with permanent roughness and wartiness of skin and a chronic desquamative progress going on. The tendency towards the formation of warts may persist long after workmen have ceased to work in paraffin departments and have not been further exposed to causes of irritation.

Chronic dermatitis as described above usually coexists with old-standing papular dermatitis, in which the papules are of the indurated type, being hard and scaly. Thus in an advanced stage the forearms show pigmented patches, small white areas of atrophied skin, scars, scaly warts, and indurated papules.

The distribution of erythematous dermatitis is confined solely to parts in contact with paraffin substances. The forearms principally are affected, either in parts (especially over ulnar aspects) or generally. In advanced cases, the lower thirds or halves of the arms are usually also affected. Occasionally the dorsi of the feet show the condition to a slight degree, but there has not been seen the same amount of induration, the feet being better protected. The palms of the hands may show a slight tendency towards exfoliation of the epidermis, which becomes thickened and fissured as a result of the dermatitis.

The erythematous dermatitis of paraffin workers differs from others forms of dermatitis venenata in that there is never any tendency towards moistness of surface. There is never vesiculation or any formation of bullae, the general tendency being to assume a chronic course, and induration is of frequent occurrence. Dryness of the affected parts is the feature of paraffin workers' dermatitis, but an occasional slight excoriation of scar tissue, from injury or climatic conditions, may be seen. While a considerable proportion of the older workmen show evidence of healed or old-standing dermatitis, the condition has become less evident in recent years, and is practically confined to those who have been paraffin workers for years, the recent employees being free from this type of skin lesion.

7. *Epithelioma (Paraffin Workers' Cancer).*

Epithelioma as seen among the paraffin workers of the Scottish oil industry occurs in workmen about or over middle life who have been paraffin workers for long periods. It usually arises from the scaly warts which form as a result of the chronic dermatitis already described, or from an old papule, especially of the indurated type. The warts or papules giving rise to this lesion have as a general rule existed for a number of years in a benign form, until the epithelial covering begins to proliferate more rapidly, with increasing growth of the primary lesion, until the characters of malignancy develop. In the early stages of the degeneration the naked-eye appearances vary according to the primary condition, so a short outline of the development from a wart and a papule may conveniently be described.

(*a*) *Arising from Scaly Wart.*—In the benign condition the wart is somewhat oval or circular, about the size of a sixpence. It is covered by small scales which are readily removable, leaving a somewhat indurated base. The wart does not protrude to any extent above the level of the surrounding epidermis. As the epithelium undergoes proliferation, the wart increases in area and also becomes more raised above the level of the surrounding skin, until it gradually assumes the size of half a crown in area, raised about a quarter of an inch or more above the surface, and covered with thick horny scales. On reaching this size there is a tendency for the formation of fissures, or abrasions of the surface, from which a serous fluid exudes, causing crusting of the surface. The crusts are readily removed by any slight injury, but re-form. This appearance persists for some months, the area gradually increasing until the incrustation and warty covering of the growth eventually slough and disappear, leaving a superficial ulcer, from which sero-sanguineous fluid exudes. Subsequent growth of the ulcer in depth and size takes place slowly.

(*b*) *Arising from a Papule.*—An indurated papule has been already described as occurring in old-standing erythematous dermatitis. The papule as a rule persists in this benign form for many years. A central necrotic area may form, accompanied by the gradual growth of the primary lesion. After separation of the slough it may grow until it assumes much larger proportions than formerly, the growth having a central ulcer, surrounded by indurated edges. The growth of the ulcer extends peripherally and also in depth, the edges being indurated and undermined, until all trace of elevation of tissue above the level of the surrounding skin disappears, so that a large open ulcer is formed, with a base of red, angry-looking granulation tissue, bleeding profusely on the slightest touch.

When the growth is situated on the scrotum there is, as a rule, in the ulcerative stages, an overgrowth of epithelial tissue forming large masses, protruding above the surrounding surface, giving the appearance of a cauliflower excrescence, and, being very vascular, they bleed profusely. Ultimately the lymphatic glands are involved in this excrescence, so that in the latest stages the whole inguinal region is invaded by a large ulcerating cauliflower-like mass. The malignancy for a long time is not great as the lymphatic glands do not become involved till a late stage, but this varies according to the situation, the glands being involved earlier when the lesion is situated on the scrotum than when the site is on the arm or forearm. The most common situation is on the back of the hand or on the lower third of the forearm, but it also occurs on the scrotum, and it has been seen on the face, and at the outer and inner angles of the eyelids, in which latter case the features of a rodent ulcer may be assumed.

Epitheliomata also occur among retortmen, labourers, and stillmen. In these men the epitheliomatous growth does not arise from a previously existing condition due to the action of paraffin, such as a papule or wart as already described, but generally begins as a reddish pea-shaped nodule, in which the typical "cell-nests" are present practically from the onset, or on the site of an ordinary simple papillomatous wart or mole, or small cyst. There is the usual epithelial proliferation, accompanied later by the degenerative changes associated with an epitheliomatous growth. The epitheliomata which occur in oil workers and labourers, as distinguished from paraffin workers, without any primary condition of dermatitis, are as a rule found among those men—such as retortmen, labourers, stillmen, oil workers, etc.—who come into contact with ash, coke, or other gritty material. The scrotum is most frequently the site of such lesions, this being due to the difficulty of ensuring cleanliness of this region.

I have made a list of all cases of paraffin epithelioma which have occurred since 1900. In all 65 cases have occurred, of which 19 have been in paraffin workers proper, and 46 among the other grades of labour employed, such as retortmen, labourers, etc.

In the oil works comprised under Scottish Oils, Limited, there have been employed approximately five thousand workmen annually for many years, which number includes all forms of labour necessary in the distillation of oil shale and the refining of its products. It will be thus seen that the cancer incidence is approximately 1½ per cent. in twenty-two years, or under 0.1 per cent. per annum. Nineteen of these cases have occurred among those definitely known to have been employed in green sheds (paraffin sheds or crude paraffin departments), there being approximately two hundred men thus employed annually by Scottish Oils, Limited, during those years. The incidence of this condition among these workers is thus 0.5 per cent. per annum approximately. The ages of the cases recorded vary from 37 to 79 years.

Three were under 40 years of age.
Thirteen were between 41 and 50 years.
Twenty-six were between 51 and 60 years.
Sixteen were between 61 and 70 years.
Ten were between 71 and 79 years.

The sites of the epitheliomatous lesions were:

Scrotum	31	47.7%
Arm, forearm, and hands	21	32.3%
Face	4	6.0%
Ear	3	4.6%
Nose	2	3.0%
Groin	1	1.6%
Lip	1	1.6%
Anus	1	1.6%
Leg	1	1.6%

Of the nineteen cases among paraffin shed men the lesions were most prevalent on the arms, forearms, and hands thus:

Hands, forearms, and arms	12	63%
Face, neck, and ear	3	16%
Scrotum	3	16%
Groin	1	5%

These figures are in accordance with the facts stated that among oil workers, retortmen, and labourers the tendency is for the primary lesion to occur on the scrotum, being malignant practically from its early stages, while among paraffin shed workmen, as a general rule, the lesion occurs as a degenerative stage of warts or papules, which are most commonly situated on the forearms.

Etiology: Exciting Cause.

Paraffin Scale.—It has hitherto been believed that the scale itself was the cause of the dermatitis (H.M. Factory Department Reports, 1913), but recent experiments with animals have clearly shown that the actual cause is the oil, before and after separation of the scale, and that the scale itself is not the cause of the dermatitis. While the exciting cause has been found to be the oils, the actual constituent of those responsible has not yet been determined. Various theories have been advanced, but so far no one has been definitely substantiated with any degree of certainty.

1. *That Nitrogenous Compounds may be the Exciting Cause.*[1]—In criticism of H. C. Ross's paper it may briefly be stated that all nitrogenous compounds are eliminated during the process of manufacture of the various final products, so that nitrogenous compounds as a cause of paraffin dermatoses may practically be dismissed from further consideration.

2. *Arsenic as a Cause of Paraffin Dermatoses.*[2]—As far as the paraffin workers of this industry are involved it may be said that arsenic is found in the raw material, oil shale, but only to an infinitesimal extent. It is also true that the dermatoses have some similarity to arsenic conditions, but nevertheless it can be said with certainty that the paraffin workers' dermatoses are not due to arsenical poisoning. On analysis of an average sample of oil shale it has been found that arsenic is present to the extent of 0.00056 per cent. by weight, or 0.0392 grain per lb., and that in the blue oil, which the workmen handle, it is present

[1] H. C. Ross, in paper on occupational cancer, *Journal of Clinical Research*, vol. iii, No. 4, October, 1918, p. 321.

[2] Dr. Bayet, of Brussels—*Comptes Rendus Académie des Sciences*. Paris, 1919, vol. clxviii, pp. 701-706.

to the extent of 0.000015 per cent. As the process of manufacture of the finished products of shale involves repeated distillations, and frequent treatment with acid and soda, it is certain that any arsenic, if present, is eliminated, and, on the other hand, no skin eruptions occur in the crude oil department, in which they might be expected to appear, if due to arsenic intoxication.

3. *Light in the Form of Radio-active Substances as Cause of Paraffin Dermatoses.*—The influence of light and actinic rays is well known as the cause of epidermic hyperplasia. In the tropics conditions known as solar keratoses are found, due to the heat and high actinic power of the sun's rays. It is improbable that a radio-active substance is the determining factor in the causation of the various forms of paraffin dermatoses described, as these would be much more widely distributed, and it might be expected that many of those coming into contact with the various grades of oil, refined wax, burning oils, and other final products would also be affected, all these products being hydrocarbons from a common source.

Organic Sulphur Compounds as a Probable Cause.—The presence of sulphur, in the form of organic sulphides, is constant in oil shale, in the crude and semi-refined products, and to some extent in the finished products as well. These exist as thio-alcohols or mercaptans, and are present throughout the different processes of distillation and treatment of the intermediate products. Similar types of lesions are found among tar workers, these also being engaged in distillation of hydrocarbons, with a considerable proportion of sulphur impurities. The possibility of sulphur as a cause of paraffin dermatoses must therefore not be overlooked.

The position may be summarized thus: The various forms of dermatitis, whether papular, pustular, or erythematous, found among paraffin workers are due to direct contact with some chemical substance which, by the formation of warts and indurated growths, acts as a predisposing cause of epithelioma, and that the determining factor or exciting cause of epitheliomatous degeneration is, in common with all other forms of cancer, unknown.

Predisposing Causes.

Age.—The influence of age is slight as a predisposing cause of papular or erythematous eruptions. On the other hand, it has a decided influence on the occurrence of epitheliomatous lesions, these practically never being got on men under 40 years of age, and as a rule these appear at more advanced ages than this.

Length of Service in Paraffin Departments.—Length of service is of considerable importance in determining the nature of the skin lesions. As previously stated, the primary form of pustular dermatitis appears after a few weeks' work in the paraffin sheds. The papular types likewise appear after a few weeks' service in these departments. The presence and degree of erythematous dermatitis are in proportion to the length of service. The less extensive and less indurated conditions begin to appear after seven or eight years, while the more indurated and more chronic types are only seen on men who have completed many years of service, the worst cases having been continuously thus employed for terms varying from twenty to forty years. Epitheliomatous conditions are only found after long terms of service, these usually arising from chronic warts or papules, which may exist in a benign state for many years before undergoing epitheliomatous changes. Those affected during recent years have been paraffin workers for periods from thirty to forty years.

Idiosyncrasy and Predisposition.—Accumulated evidence tends to show that some workmen have a greater tendency to be affected than others, the working conditions otherwise being the same. It has already been suggested that there may be an idiosyncrasy on the part of a few youths towards the action of semi-refined oils, by their having pustular eruptions soon after beginning work, while the majority escape. Likewise the fact that only approximately half of those working among the same materials and under the same working conditions suffer has never been otherwise explained, and the only reason that can be advanced is that there is greater tolerance on the part of some than of others. I have had occasionally under observation large warty growths with central necrosis, and suggestive of the stage immediately preceding malignancy, which instead of undergoing epitheliomatous degeneration have healed after separation of necrosed area. Cases such as those might be considered as only lacking in the personal factor, which must have a certain amount of influence in determining the development of a benign into a malignant condition. These facts are suggestive that an idiosyncrasy may exist towards the action of paraffin substances, and that the personal element is a factor of some importance in the further development of warts and papules into epitheliomata. The following table shows clearly the proportion of those unaffected at four recent examinations since 1919:

	Green Shed Men (Crude Dept.)	White Shed Men (Refining Dept.)	Green and White Shed Men.
February, 1919 ...	28.7%	71.2%	42.0%
August, 1919	29.5%	83.0%	44.5%
March, 1921	35.4%	94.3%	49.3%
August, 1921	39.1%	91.4%	47.9%

It will therefore be seen that a considerable proportion of men escape, many of whom have been paraffin workers for long periods. On the other hand, a number of those having eruptions have been paraffin workers for short periods only.

Want of Cleanliness.—In recent years very considerable attention has been paid to the importance of cleanliness, and facilities have been freely given for this purpose, as will be described later. Notwithstanding strict attention in this respect it cannot be said that the incidence of early or papular eruptions has been more than slightly diminished, but, on the other hand, there has been a marked diminution in the frequency of the more chronic types, such as erythematous dermatitis—so much so, that recent erythematous dermatitis is now uncommon, while the more chronic and old-standing conditions may be said to be more prevalent among those whose habits of cleanliness in the past might have been improved—that is, the influence of greater attention to cleanliness has been followed by a lessening of this form of occupational eruption.

Table showing the Results of Five Examinations of Green Shed and Sweating Shed Workmen Combined.

(Workmen in crude paraffin departments and in paraffin refineries.)

Dates of Examinations.	March-April, 1919.	July-August, 1919.	March, 1921.	Sept., 1921.	Feb., 1922.
No. of men examined	188	146	148	113	80
Group 1 ...	79 = 42.0%	65 = 44.5%	73 = 49.3%	60 = 53.1%	31 = 38.7%
Group 2 ...	29 = 15.4%	46 = 31.5%	24 = 16.2%	31 = 27.4%	15 = 18.8%
Group 3 ...	56 = 29.8%	24 = 16.4%	42 = 28.4%	21 = 18.6%	27 = 33.7%
Group 4 ...	21 = 11.2%	11 = 7.6%	9 = 6.1%	1 = 0.9%	7 = 8.8%
Group 5 ...	3 = 1.6%	None	None	None	None

The average frequency of eruption for the five examinations is:

Group 1. Those having no occupational eruption 45.5%
Group 2. Those having a few papules only... ... ... 21.4%
Group 3. Those having limited degree of eruption 25.1%
Group 4. Those having extensive eruptions 7.6%
Group 5. Those showing presence of warty growths 0.4%

Seasonal Conditions.—As a general rule occupational conditions are worse during winter months. As might be expected, cold, by lowering the vitality of the skin, accentuates old-standing eruptions, especially those of the nature of dermatitis erythematosa and erythema simplex. In the former condition the skin is more roughened and scaly, and the warty excrescences are more numerous during winter and spring than in summer months.

Measures Adopted for the Protection of the Workmen.—During recent years a great deal has been done for the protection of the workmen in the paraffin departments in the various works. These consist of the provision of adequate facilities for ensuring absolute cleanliness of bodies and clothing of the workmen, the use of protective applications for the exposed parts, and regular medical inspection every three months.

Protective Applications.—So far as is at present known, the best protective application is castor oil, especially in its semi-crude thick state. This is insoluble in any of the paraffin series, and so forms an impervious covering for the arms, etc. Before beginning work each workman smears his hands and arms, and

occasionally his legs, with castor oil, and occasionally throughout the working day after washing. This has been in use for a long time in the paraffin departments, as nothing better has yet been found.

Protective Clothing.—No practical form of clothing has been found that can withstand the extremely searching and solvent action of the paraffin series. Leather, rubber, and other waterproof materials are readily acted on, and rapidly become saturated with oils, and are not of any real use, though some of the workmen place layers of brown paper inside their boots before beginning work, this being discarded each day.

TREATMENT.

The various methods of treatment, all of which are purely local, are carried out on the ordinary lines of treatment for skin diseases generally. Occupational comedones are readily removed by the usual method of expression. Papular conditions readily disappear on ceasing work in paraffin sheds, and as a rule require little or no treatment, as in the early stages these tend to heal spontaneously. Mild antiseptic pastes, such as boric ointment, suffice to prevent septic infection, though this is uncommon, as the oily materials worked with are themselves both aseptic and germicidal. In the more acute forms of erythematous conditions sedative applications are of use, the most effective being ichthyol and lead preparations. In the more chronic types these are also useful, or pastes of zinc oxide and salicylic acid, and if wartiness is a prominent feature stronger preparations of salicylic acid are beneficial. In the more rapidly proliferative warty conditions, salicylic and chromic acids readily remove superficial warts, but when these extend more deeply into the skin tissue carbon dioxide snow is of greater service. On any appearance of warts or nodules proliferating too rapidly with excessive growth, removal by excision is a sure method of treatment, and it is exceptional to find recurrence.

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Reviews.

THE PLACE OF VERSION IN OBSTETRICS.

OBSTETRICIANS will receive Dr. POTTER'S monograph on *The Place of Version in Obstetrics*[1] with an interest born of the stir which his methods and writings have caused in the United States, whereof rumours have reached us on this side of the Atlantic. Those who peruse the volume will find it to be well written, illuminated with much quiet humour, and wholly devoid of any apparent resentment or rancour against critics who have sometimes dealt more faithfully than politely with the author.

The plan of the book is a survey of the history of the operation of version from the earliest times to the present day, with a rather more detailed consideration of the position which the operation holds in the accepted teaching of obstetrics at present. This is followed by a full and well-illustrated description of the author's own method of performing internal version, by a reply to certain of the criticisms which have been made, and by a chapter on indications and the author's general conclusions. The historical sections are admirably done, and provide most interesting and entertaining reading. In his description of what we may call the revival of version in the early nineteenth century, the author relates with sympathetic fullness the story of Sir James Y. Simpson and Mr. Figg. Apparently Mr. Figg is the direct intellectual ancestor of Dr. Potter, because after Simpson had, by means of internal version, successfully delivered of a living child a woman whose previous three children had been born dead after long forceps and embryulcia, he was so filled with enthusiasm for the operation that he began to adopt it more and more frequently until it became practically his one method of delivery. The reason was, apparently, that if version can be so successful in the case of contracted pelvis it ought to be much more successful in normal conditions! So far as one can see, Dr. Potter's reasoning is on very similar lines, and his conclusions are identical. His method, however, varies in some important respects from that of his predecessor. Dr. Potter now delivers at least 90 per cent. of his patients by internal version, and in his last 938 cases the maternal mortality was *nil*, and the foetal mortality certainly not greater than that associated with good obstetrics on recognized lines. Whatever criticism, therefore, we may have to offer upon Dr. Potter's thesis, we cannot withhold a tribute of admiration to the individual skill he has attained in this method of treatment, and of congratulation upon his admirable results.

The special points in his method to which we would refer are, first, the necessity of very careful surgical preparation in regard to antiseptics and asepsis, and the use of long rubber gloves up to the elbow. Secondly, the patient is put in a modified Walcher position; the limbs are held by two nurses, if available, otherwise they rest on chairs. Next, deep anaesthesia is a *sine qua non*, and for safety this of course necessitates the assistance of an accomplished anaesthetist. The operation is begun by "ironing out" the vagina by a process of stroking and stretching with the gloved fingers. The hand is then introduced through the fully dilated cervix, the membranes separated from the uterine wall all round and ruptured as high up as possible without disturbance to the placenta. *Both* feet of the infant are then brought down to the vulva in the ordinary way. No haste is exercised in delivery after the umbilicus has come into view. The anterior arm is delivered first, and the body then rotated until the posterior arm comes underneath the pubic arch. Suprapubic pressure is not exercised until the head actually enters the cavity of the pelvis, the author believing that extension of the arms and head is often the result of premature interference with the natural powers at this particular stage. Extension of the head is overcome by gentle traction by the fingers in the child's mouth. No rough or violent methods of artificial resuscitation are employed, the author's experience having taught him that nearly all the babies begin to breathe spontaneously when let alone, provided the heart is beating. Blue babies give him no anxiety, but white babies do.

Dr. Potter claims that 60 to 70 per cent. of his cases are occipito-posterior, and he explains his figures by saying that he examines his cases early, before rotation has occurred. He also has apparently no confidence in any diagnosis of position based upon the palpation of the fontanelles and sutures. He relies solely upon the palpation of the ear and other portions of the child's gross anatomy after he has introduced his hand into the uterus. While believing that occipito-posterior positions are considerably more common than the usually quoted percentages indicate, we regard this claim as somewhat staggering. Dr. Potter does not really examine his patients earlier than do others, who, without introducing the hand into the uterus, are, we venture to assert, quite as capable of making a correct diagnosis of the position of the head as is Dr. Potter with his hand in the uterus.

In the last two years Dr. Potter claims to have personally delivered 2,243 cases, and to have performed version on 1,872. In his practice, therefore, almost every condition except those calling for Caesarean section is to be regarded as an indication for version, and this being so it is not surprising to find that the chapter on "Indications" is perhaps the feeblest in the whole book, and displays a lack of judgement. The author states that malpositions of the child were present in more than half his cases. It is of course self-evident from his figures that a very large number of the occipito-posterior positions, at any rate, would have righted themselves if left alone, and probably without undue prolongation of the labour. The author is, therefore, in the main driven back for justification upon his desire to eliminate the second stage of labour, to diminish shock and trauma, and to dispel the fear of childbirth from the minds of his patients. We are disposed to think that the dread of childbirth is not so great as Dr. Potter would have us believe. However this may be, the proper administration of morphine and hyoscin does, in British experience, abolish both this fear and all *post-partum* shock

[1] *The Place of Version in Obstetrics.* By Irving W. Potter, M.D., F.A.C.S. London: Henry Kimpton. 1922. (Sup. roy. 8vo, pp. 138; 42 figures. 25s. net.)

without risk to either mother or child. The deliberate policy of interference with the natural course of labour in perfectly normal cases is, we hope and feel sure, one which will not commend itself to British medical practitioners. We cannot do other than condemn utterly Dr. Potter's wholesale employment of version, despite the excellent results that the author personally has obtained. At the same time, it seems that Dr. Potter's technique is in some points an advance on the ordinarily accepted method of internal version—in particular, in the avoidance of hurry (and the usual attendant flurry) in delivery of the thorax, arms, and aftercoming head, and in the avoidance of violent methods of resuscitation of a "blue baby." It is well for us to be reminded of the value of version, carefully executed, in many conditions in which at present recourse is had to the forceps operation, almost without thought of any possible alternative. While, therefore, we wholly disapprove of Dr. Potter's thesis, we think that his ardent advocacy of version will have no ill effect upon the teaching of obstetrics—possibly the reverse. Certainly he has produced a book which, however much we may disagree with the teaching, is eminently readable. He is to be congratulated upon the excellence of his illustrations and the charm of his style.

RADIUM THERAPY.

A very comprehensive book entitled *Radium Therapy*,[2] the work of Dr. Frank Edward Simpson, Professor of Dermatology of the Chicago Policlinic, is intended primarily for those actually engaged in radium therapy, but the author wishes it also to serve as a reflex of the current practice in this branch of medicine. Following upon chapters which teach of radio-active substances and radium itself from the historical point of view, the physics and the properties of the alpha, beta, and gamma rays are described in detail; in chapter vii the author's experimental work on the absorption of gamma rays in water as measured by two types of ionization chambers is set forth, and illustrated by means of diagrams.

There are two chapters on the biologic effect of radium rays which largely consist of a summary of the more important work which has been done by various research workers. References are made to the stimulation of tumour growth by insufficient radiation, but the author's clinical experience has not convinced him that any actual stimulation of tumour growth by radium rays occurs. He doubts, indeed, whether this would be possible under the modern method of large primary dosage. In discussing the problem of immunity to malignant disease it is suggested that it is possible that the different response of similar tumours to radiation depends to some extent upon the systemic defensive powers of the organism, and that the lymphocytic system is of importance in connexion with the disappearance of malignant growths under the influence of radiation. The chapter on dosage is written largely from the mathematical point of view, and the results of many mathematical calculations considered to be of value in estimating the intensity of radiations from different apparatus at different distances are set forth in tabular form.

We come next to the main portion of this book, which deals in separate chapters with radium in general surgery, in gynaecology, in dermatology, in ophthalmology, otology, rhinology, and laryngology; there is also a chapter on the treatment of the ductless glands, and one on radium in internal medicine. Reference is made also to professional injuries due to radium. A bibliography which is comprehensive and takes up nearly sixty pages brings the work to a conclusion. Full-page illustrations of cases before and after treatment afford striking proof of the good results which can sometimes be brought about by radium treatment and serve to emphasize its value as a therapeutic agent. The author shows many examples of naevi and angiomata of the face treated with unusually good cosmetic results.

The book is well printed on excellent paper, and the numerous illustrations are finely reproduced. The general arrangement of its text should make this a valuable book of reference for anyone requiring hints for the treatment of individual cases; and as a whole it is a very complete textbook of the present position of radium therapy.

[2] *Radium Therapy.* By F. E. Simpson, A.B., M.D. London: Henry Kimpton. 1922. (Roy. 8vo, pp. 391; 166 figures. 36s. net.)

THE CRITICAL AGE.

Dr. Arthur Leclercq has written an attractive volume[3] on the rather depressing subject of the affections specially prone to appear at the turning point of life when, as he pictures, the traveller, having at last reached the summit of the hill, begins to descend, and thereafter does so with increasing rapidity. At this period the organism usually—though there are exceptions, and of course many will consider their case to prove the rule—is beginning to show signs of exhaustion, and the functional vigour of the organs is on the decline. The pathology of the critical age is regarded as comprising three main groups of diseases: First, those of endogenous origin, gout and "paragouty" affections, which cover a wide field and recall Murchison's lithaemia—namely, asthma, bronchitis and emphysema, eczema, herpes, acne, prurigo, dyspepsia, pharyngitis, tonsillitis, hepatic congestion, mucous colitis, haemorrhoids, renal colic, cystitis, urethritis and calculous pyelonephritis, migraine, facial neuralgia, sciatica, arthropathies, and myalgias. In this first category are also included obesity, diabetes, arterio-sclerosis, and granular kidney. The second group contains the exogenous affections due to infections, such as syphilis, enteric, rheumatic fever, and influenza, fifteen to twenty years previously, the effects of which accumulate and show themselves in cardio-vascular and renal lesions. The third group, the exo-endogenous, due sometimes to an external cause, such as alcohol, lead, or tobacco, or to premature age, does not appear to be a very sharply cut one; it is described as including the manifestations of arterio-sclerosis, such as dyspnoea, angina pectoris, cerebral attacks, and uraemia. The lesion is referred to as the result of the rust of life and as attacking the internal coat alone of the vascular system. Descriptions are given of gout, "paragouty" affections, and obesity; on the first page of the section on the pathogeny of gout there is a well-meant tribute to the labours of British physicians, among whom Murchinson, Luft, Dyce-Duckwort, and Lathan have suffered from the printer's unfamiliarity with our spelling.

An interesting, if not entirely convincing, distinction is drawn between obesity in males which is regarded as alimentary, and that in women which is in the main referred to toxaemia caused by ovarian or polyglandular defect and by failure to eliminate the poisons in the menstrual flow.

It should be explained that this is a first volume of a new edition of a work on the diseases of the fifties published by the same author eleven years ago and reviewed in the second volume of this Journal for 1911, p. 74.

AN INDEX OF THERAPEUTICS.

It was a happy idea to include in the series of Oxford Medical Publications a volume such as the *Oxford Index of Therapeutics*,[4] edited by Dr. Victor E. Sorapure. The purpose of the book is, in the editor's words, "to extend the interchange of ideas and of the methods of practice of each of the great branches of the English-speaking practitioners of medicine." Dr. Sorapure claims to have had exceptional opportunities of judging the needs and interests of both British and American doctors, and no one will deny the justice of his claims. The book is designed first, foremost, and all the time as an up-to-date book of reference for the general practitioner, embodying the best teaching of England and America. With this object the editor has secured the services of a number of distinguished contributors from Great Britain and the United States, all of them recognized as authorities on the subjects with which they treat. The aim of each of them is to give simply and briefly what he considers to be the best method of dealing with the particular condition he may have under review.

The work is arranged in four sections. Part I, on methods, occupies by far the largest portion of the volume. It consists of a series of monographs arranged in broad groups wherever the clinical relation is such as to justify it. Thus, under "Obstetrics" we find discussed the treatment of all the normal and abnormal conditions pertaining to pregnancy and parturition; similarly with genito-urinary conditions, diseases of children, heart conditions, and so forth. Such subjects as do not fall conveniently into these groups are arranged in alphabetical order. The editor insists that "the alphabetical

[3] *Les Maladies de la Cinquantaine.* Tome I: *L'Age Critique.* By A. Leclercq. Paris: G. Doin. 1922. (Demy 8vo, pp. 176. 10 francs.)

[4] *The Oxford Index of Therapeutics.* Edited by Victor E. Sorapure, M.B., Ch.B., F.R.C.S.Edin. Oxford Medical Publications. London: Henry Frowde, and Hodder and Stoughton. 1921. (Demy 8vo, pp. xvi + 1126; 109 figures. £2 2s. net.)

order . . . is not intended to serve mainly for purposes of reference. This is the function of the index." It must be conceded that there are certain advantages in arranging the subject-matter in this way. For instance, it admits of a subject like radio-therapeutics being dealt with in a thoroughly comprehensive manner under a single heading. But on the other hand, a book of this kind is more often used for making a reference to some particular subject, possibly in the course of a round of professional visits, rather than for continuous reading. A strict alphabetical arrangement such as is generally adopted in works of this character will generally be found more simple and expeditious by the reader and will frequently save him any necessity to refer to the index. This is only a minor criticism of the manner in which the matter is presented.

As regards the subject-matter itself nothing but praise can be accorded. The names of the authors are sufficient guarantee for the soundness of the advice given, and it is amazing how much valuable and practical information has been crammed into the space available. Only those methods of treatment which are by common assent agreed to fall within the province of the general practitioner are recommended. The teaching throughout is based on accepted principles and well-tried methods, and therapeutic stunts find no place in these pages. Where need arises useful illustrations, generally in diagrammatic form, have been inserted in the text. Part II is a pharmacopoeia of those drugs only which have been mentioned in Part I, while in Part III these drugs and preparations are classified under their pharmacological properties. The practitioner should find Parts II and III most useful as adjuncts to Part I. Part IV consists of an excellent index which permits at once easy and rapid reference being made to any subject in the text. It can truthfully be said that the editor and his collaborators have worthily achieved their object in providing English-speaking practitioners with a handy and reliable book of reference. They are heartily to be congratulated on the successful result of their labours.

NOTES ON BOOKS.

MESSRS. OLIVER AND BOYD have issued a fifth edition of a folder entitled *Income Tax—Tabular View*.[5] It is a concise statement, has evidently been carefully prepared, and supplies a mass of useful information in a most accessible form. The tables include the past and present rates of income tax and super-tax, the money value of various totals of allowances, and the tax borne on and the gross equivalents of various net (that is, tax-free) dividends; but most taxpayers will find even more useful those sections which are designed to set out as briefly as possible the various claims which can be made, or the thirteen succinct paragraphs of reminder and advice. It should be said that in the main the information given is directed to enabling the reader to ascertain the proper amount of tax payable in various circumstances on a known amount of income; even the ingenuity of the authors could hardly provide, within the limits necessarily set by conditions of production, much information on points arising on the ascertainment of the amount of the income to be assessed, though it is in that connexion that the need for a concise means of reference is sometimes most keenly felt.

In *Paris à la Carte: Where the Frenchman Dines and How* Mr. SOMMERVILLE STORY[6] supplies a real want by conveying the information so essential to visitors to the capital which he designates as the city *par excellence* of restaurants. He writes in a pleasant, gossipy strain, with anecdotes about the history of the famous restaurants, cafés, and houses, their proprietors, habitués, and special plats. The atmosphere of Paris is so successfully created in the first chapter on "the apéritif hour" that many readers will mentally eat their dinners over again with a pleasant sense of reminiscence. The ground is fully covered without tiresome detail, and all tastes are catered for. *La Tour d'Argent*, whither only true gourmets go, and which, as it never advertises, is little known to the ordinary tourist, and Duval's numerous establishments, where it is still possible to get a modest meal, with half a bottle of wine or mineral water, at a reasonable price, receive equal attention. There are attractive chapters on "The traditions of *la haute cuisine*," and on "The romance of some famous dishes." When a second edition appears—and it cannot be long before it is called for—an index would add to its utility, though it would be difficult to increase its charm.

[5] *Income Tax—Tabular View*. London and Edinburgh: Oliver and Boyd. (1s. net; post free 1s. 2d.)

[6] *Paris à la Carte: Where the Frenchman Dines and How*. By Sommerville Story. London: A. M. Philpot, Ltd. 1922. (Fcap. 8vo, pp. 220. 4s. 6d.)

THE HEALTH AND HEALTH ADMINISTRATION OF ENGLAND.

(Continued from page 324.)

IN continuing our notice of Sir George Newman's report on the State of the Public Health in 1921 we may take next the section dealing with tuberculosis.

TUBERCULOSIS.

The basis of preventive action is laid down as twofold—first, to fortify the powers of resistance by nutrition, hygiene, and immunization, and secondly, to prevent spread of infection by persons or materials, including meat and milk. Steady progress is claimed for this policy in 1921, especially as to (*a*) earlier notification, (*b*) selection of patients for institutional treatment and in its duration, and (*c*) economical utilization of the various parts of the national system. A substantial reduction of expenditure is hoped for, with reduction of the disease.

Following the war increase in the mortality there was a rapid drop in 1919 to the lowest rate on record, and a further considerable fall in 1920. In 1921, however, there was a small rise in deaths from phthisis, though in those due to other forms there was a small decrease. Sir George Newman suggests that the increase may have been associated with unemployment and inadequate nutrition, as illustrated in Germany and Poland.

Notifications of new cases, both pulmonary and non-pulmonary, were in 1921 the lowest on record, though the rate of diminution was not so rapid as in the two previous years. Notification is still incomplete and delayed. At Barnsley 87 per cent. of the fatal cases were either unnotified or notified only within six months of death. At Bath, of 54 fatal cases only 35 had been notified, 9 of them within three months of death. In one district 208 of 350 notifications were not received until after the stage when a cure could be expected, owing to delay either in getting a medical opinion or in recommendation for treatment. In Lancashire, however, 70 per cent. of new cases were intimated for the opinion of the tuberculosis officer before notification. Examination of contacts is still insufficiently carried out, sometimes owing to want of staff, but often because cases are retained too long at dispensaries instead of being handed over for domiciliary treatment subject to occasional consultation with the tuberculosis officer.

Tuberculosis Schemes.

Dispensaries number 421. Residential institutions are 443, of which 210 are provided by the local authorities, and the rest are voluntary. The beds in the former are 11,262 and in the latter 7,681, a total of 18,943. Owing to local circumstances a considerable margin are at any given date unoccupied.

Administration often lacks co-ordination; "there is still in many areas too much of the out-patient room atmosphere in the dispensary, too little examination of contacts, and insufficient preventive work." The tuberculosis officer should be in close touch with the general practitioner, who should treat as many cases as possible at home. The officer, it is pointed out, should consult with the practitioner and use the reports under the Medical Benefit Regulations; he should also report his periodical examinations to the practitioner. Valuable as are the reports of health visitors, the tuberculosis officer should occasionally visit himself, but this is not done everywhere. Supervision of patients using shelters should be effectively carried out.

Sanatorium benefit was transferred on May 1st, 1921, from the insurance administration to the county or county borough councils; and the Public Health (Tuberculosis) Act of 1921 imposed on councils the duty of providing treatment schemes, and circulars and regulations were issued for the new arrangements. Preferential treatment of ex-service men has been continued.

The reports of a number of medical officers of health lead to the opinion that the proportion of persons alive and employed five or more years after residential treatment is relatively large, looking to the late stage at which the majority came under treatment, and "residential treatment should not be lightly condemned as a failure—rather we should be encouraged that the results have been so good." It may prolong life and working capacity, even where admission is at too late a stage for arrest.

Care and After-care.

Investigation by the Ministry shows that excellent work is being done. The sociological problems require early treatment as well as the patient. Various pertinent hints are given as to training sections for ex-service men; 410 places have now been provided, and will shortly be occupied. They are intended to teach men to work on their own account in suburbs, country towns, or villages, at market gardening, rural carpentry, furniture repairing, house repairing, tin-smithing, brush and basket making, jewellery, and watch and china repairing. It is not expected that the work will be commercially successful at once; the men are mostly damaged lives. The new plans differ from industrial colonies in that the men will have to return to normal competitive life.

In his conclusion as to tuberculosis Sir George Newman says: "The solution of the problem will be found in a social evolution, in the broad acceptance of the way of health, domiciliary and industrial. Tuberculosis is a harvest, the effect of a cause, a seed sown in a favourable soil. We must restrict the seed sowing, and we must make the soil unfavourable and resistant."

GENERAL EPIDEMIOLOGY.

In classifying preventive measures Sir George Newman places sanitary environment first, individual resistance second, and avoidance of infection third.

Small-pox.—The number of cases of small-pox notified was 343. Of these 7 were notified at ports; 23 more were discovered, 3 of them at ports; 30 notifications were withdrawn on revision of diagnosis, so that the net total was 316. The centres were Nottingham, Middlesbrough, and the Colne Valley. The Nottingham area had 142 cases with no deaths. School children to the extent of 42 per cent. were unvaccinated, but 10,000 persons were successfully vaccinated or revaccinated at the public expense. In the Colne Valley there were 94 cases of a mild type, but a group in the New Forest was of virulent type, and vaccinal condition made the usual distinction. The same remark applies to a statistical table relating to the cases throughout the year. The term "alastrim" was used in reporting three of the cases.

Enteric Fever.—Details of a serious outbreak of enteric fever at Bolton-upon-Dearne and contiguous districts in the West Riding were published in our note on Dr. W. Vernon Shaw's special report to the Ministry (BRITISH MEDICAL JOURNAL, July 8th, 1922, p. 56). Shellfish caused various small outbreaks in the course of the year.

Scarlet Fever.—The number of notifications of scarlet fever was 137,073, an increase over 1920. The disease was mild and the mortality low. Administrative measures in scarlet fever are being considered by the Ministry in view of the heavy call the disease makes on institutional accommodation.

Diphtheria.—Stress is laid on the Schick test.[1] The classification of carriers in accordance with their infective ability is receiving attention. Emphasis is laid on the advisability of giving antitoxin as soon as a diagnosis is reached on clinical grounds, without waiting for the laboratory report; the minimum initial dose, it is thought, should be 8 000 units, followed by another administration in twelve hours if notable improvement has not occurred.

Influenza.—The report on this disease covers, in addition to 1921, the first quarter of 1922, as the epidemic which began in October, 1921, only then attained its climax. In the early part of 1921 the disease was very little prevalent. The last outbreak, it is said, bore the same relation to the pandemic of 1918 as did the epidemic of 1895 to the pandemic of 1892. In the recent epidemic few divisions of the country remained ultimately unaffected. The strain was less severe than in 1918-19; lung involvement was comparatively infrequent; fatality was most marked at the two extremes of life, and generally the type was interpandemic, though gastro-intestinal disturbances were rather frequent, especially in the northern and midland areas. Rashes also occurred, and there were instances in which jaundice in children preceded the epidemic by four or six weeks. But the main stress was on the respiratory system, though pneumonia was not specially prominent.

Encephalitis lethargica, polioencephalitis, poliomyelitis, and *cerebro-spinal fever* are briefly reported on. A progressive increase of the number of cases diagnosed as encephalitis lethargica has occurred during the last three years; polioencephalitis and poliomyelitis were also more frequent than in the previous year, but cerebro-spinal fever showed a steady diminution from 1915, when the number was 2,566, to 1921, when it was only 411. The Ministry has been co-operating with the Medical Research Council in trying to get an effective curative serum against Type II meningococcus.

RELATION OF FOOD TO HEALTH AND DISEASE.

Milk.—The conditions of milk production in seventeen districts were examined. Producers of "certified" milk (the highest standard) increased from 9 in 1920 to 23 in 1921, and of Grade A milk from 11 to 15. Retailers of the former increased from 7 to 44, of the latter from 5 to 6, and of both from 3 to 5. One producer's licence was revoked. Bacteriological standards, as for "certified" milk, are found very efficacious, and less troublesome to supervise than the detailed requirements for Grade A, which ought also to have a bacteriological standard. The National Institute for Dairy Research at Reading is doing good work.

Meat Inspection.—The report of the Departmental Committee, published in July, showed that there is no conflict between public and legitimate trade interests. The Committee agreed that better and more uniform inspection at slaughtering is needed, and can be carried out economically. Sanitary inspectors should be specially educated in such work. Facilities for practical study are being extended by the larger authorities.

Food-poisoning inquiries have been the subject of arrangement with the Medical Research Council, and medical officers of health have been circularized. Various outbreaks were reported, and some were investigated under the arrangements made. Two instances of belladonna poisoning were met with, one of them due to eating rabbit snared where belladonna grew; in this case atropine was found in the liver.

Sale of Food and Drugs Act.—Over 113,000 samples were reported on by public analysts; 6.7 per cent. were found to be adulterated, as against 7.1 in 1920. The percentage of milk adulteration found was highest in Sheffield, Birmingham, Salford, and Derbyshire, and lowest in Derby, the extremes being 10.97 and 1.85. The difference between the average composition of milk and the standards under the Sale of Milk Regulations gives the adulterator a margin to work on.

(*To be continued.*)

[1] See BRITISH MEDICAL JOURNAL, 1921, vol. ii, p. 991.

BACTERIOLOGY OF PNEUMONIA AND INFLUENZA.

THE Ministry of Health has issued a report* containing three contributions to the study of pneumonia and the pneumococcus and one on the serological characters of influenza bacilli.

Pneumonia.

Pneumonia is a disease which calls urgently for further bacteriological study because it is a substantial cause of national mortality. In 1921 it was primarily responsible for 34,708 deaths in England and Wales, apart from those due to diseases in which it is the chief secondary complication, such as measles, whooping-cough, and influenza. Moreover, the important advances achieved by the grouping of pneumococcus types and the preparation of antiserums against each group have already resulted in modifications in the treatment of this disease and a considerable reduction in the mortality of those cases in which it was possible to administer an appropriate serum. Attention has been frequently directed in the pages of this JOURNAL to these researches as they have been published. The report before us contains a concise historical account of what has so far been achieved, together with an account of further contributions to the laboratory study of allied problems. When the international conference on the standardization of serums and serological tests was held in London in December, 1921, it was agreed that international co-operation was needed to ascertain the distribution of different types of the pneumococcus and to determine the best criteria for the production of effective therapeutic serums. The report answers some of the questions raised at that conference and indicates lines for further investigation.

The first report by Dr. Arthur Eastwood, entitled "A brief review of recent bacteriological work on pneumococci," points out that in the earlier work, to which Washbourn and Eyre made important contributions many years ago, attempts were made to produce antipneumococcus serum of therapeutic value, but it was not until Neufeld and Händel in 1912 demonstrated that pneumococci could be divided into groups that much progress was made; they showed that an immune serum was not possessed of any protective qualities except towards the same group against which it had been prepared. Investigations at the Rockefeller Institute subsequently showed that pneumococci could be divided into four groups, of which Types I and II possessed sharply defined serological characters and were rarely encountered apart from disease. The American Type III, or *Pneumococcus mucosus*, had distinctive morphological and cultural characteristics and was found to occur commonly in normal mouths. A large number of other strains were found which exhibited a great diversity of serological reactions, and did not belong to any of the above groups; this heterogeneous collection was termed

* Reports on Public Health and Medical Subjects. No. 13. Bacteriological Studies on Pneumococci and Influenza. London: H.M. Stationery Office. To be obtained through any bookseller. Price 2s. 6d.

Type IV. The following table shows the frequency with which these types were encountered and their virulence:

	Incidence per cent.	Mortality per cent.
Type I	33	25
Type II	31	32
Type III	12	45
Type IV	24	16

The Rockefeller workers were able to produce a serum efficacious only for Type I infections, and in these infections the mortality has been reduced to 10 per cent. The serum must be given intravenously in doses of 90 to 100 c.cm., repeated every eight hours until there is a satisfactory fall of temperature and improvement in the symptoms. In infections due to Types II, III, and IV no benefit followed administration of serum prepared against these strains.

Dr. Eastwood's review of the researches of other workers brings out certain facts of considerable importance. Thus it has been found by employing the absorption tests that serological relationship exists amongst strains which are usually regarded as antigenically distinct, and that prolonged culture in homologous serum may modify profoundly the agglutinability of different strains; these changes in the serological reactions are accompanied by loss of virulence and reduction of antigenic capacity. That there may be little relationship between agglutination titre and protective power in a serum is another fact emphasized by many workers.

Although the Rockefeller investigators were only able to produce a protracted serum against Type I infections, other workers employing different methods claim to have produced antipneumococcus serum protective against all strains. An entirely new departure in serum therapy has been made by Preston Kyes, who appears to have cured human pneumonia by the injection of serum from fowls immunized with massive doses of pneumococci. Truche has described a method for preparing a polyvalent antipneumococcal serum by inoculating horses with an antigen treated with alcohol and ether. The apparent diversity of antigenic structure amongst strains of pneumococci presents difficulties which have not yet completely been overcome, but there is an indication that ways out of these difficulties may be found, and the benefits of serum treatment secured for all forms of pneumococcus infection.

The second paper is by Dr. Frederick Griffith on "Types of pneumococci obtained from cases of lobar pneumonia." In order that workers in different parts of the world may be able to compare the results of their investigations into the prevalence of types of pneumococci in different countries and at different seasons it is necessary that some uniform method be adopted for the isolation of the organism, the preparation of the agglutinating serum, and the carrying out of the test. Dr. Griffith makes the following suggestions towards the formulation of a uniform diagnostic test. Since much confusion has already arisen from the comparison of results obtained by fundamentally different methods, he recommends that a standard method should be based on that of the Rockefeller Institute, the results of which have been confirmed in many countries. He considers it preferable that the pneumococcus should be isolated by the intraperitoneal injection of a mouse and the recovery of the organism from the heart's blood rather than by direct plating on laboratory media, one reason being that more than one type of pneumococcus may occur at the same time in the sputum, and the predominant virulent type, which will multiply in the mouse, is most likely to be the cause of disease in the human being. His experience indicates the value of the following technical details:

1. The suspensions used for agglutination should be whole broth cultures, since they give the sharpest results.
2. Agglutinating serums should be prepared in the rabbit, since this animal yields the most specific serums.
3. Strains used for immunization should be maintained in virulence and should therefore not be subcultivated for long periods on solid media.

In a series of 150 cases of lobar pneumonia, taken mainly from the London area, Dr. Griffith finds that the American Types I, II, and III occur in about the same proportion as in the United States, and he agrees that these types are serologically distinct. There remain, however, a large number of strains which differ from these three types and present many varieties amongst themselves. These unclassified strains are placed in Type IV, and it is interesting to note that these organisms are responsible for cases of pneumonia somewhat more frequently in this country than in America. In carrying out protection tests in mice the test culture should be administered intraperitoneally to ensure accuracy of dosage; such protection tests confirm the serological independence of the types of pneumococci. Protective serums act equally well, whether inoculated subcutaneously or intraperitoneally, and whether the test culture is injected immediately after the serum or after an interval of eighteen hours. The mode of action of antipneumococcal serum is still unknown, since it has been shown by absorption tests that there is no firm union between antigen and antibody and no apparent neutralization of the protective properties.

The third report is by Dr. Eastwood on "The significance of serological differences amongst pneumococci." Here are passed in review all the current general ideas about antigens and antibodies, these being considered from both the chemical and physical points of view. In Dr. Eastwood's opinion the "mosaic pattern" theory, or theory of multiple antigenic components, as an explanation of the nature of antibodies and their relation to antigens, has been pushed a great deal too far. Though of value in explaining the behaviour of other groups of bacteria showing some serological relationship, it is definitely an encumbrance when applied to the four groups of pneumococci which in their serological reactions appear to be so independent. It may be that the common antigenic element probably present in all strains of pneumococci is masked in each group by the acquirement of some secondary factor which prevents the characteristic response to the common antigenic element. There is always the possibility, also, that the pneumococcus may be changed in the living body from one type to another, for the persistence of type in prolonged subculture does not show that mutation cannot occur in the living body. The practical question involved is whether or not it will be possible to produce antipneumococcal serum for strains other than those belonging to Group I, and on this subject Dr. Eastwood expresses himself as follows:

"I think the study of serological differences amongst pneumococci has not led to any final conclusions such as would justify the opinion that no serum will be therapeutically efficacious unless it contains an antibody corresponding to the antigen which is peculiar to the infecting strain."

Influenza.

The fourth report, by Dr. W. M, Scott, deals with the distribution and serological characters of influenza bacilli and embodies the results of a study which has extended over the four years 1918–21, of which the main conclusions are:

1. Influenza bacilli have been recovered from the normal nasopharynx in over 30 per cent. of persons examined.
2. Influenza bacilli have been found in the sputum or lung in about 60 per cent. of cases of lobar pneumonia, in 88 per cent. of cases of simple bronchopneumonia and bronchitis, and, during the epidemic of January, 1922, in 65 per cent. of cases of influenza and influenzal pneumonia.
3. Agglutination tests have revealed great diversity in serological types, but certain common antigenic characters occur in a proportion of the different strains.
4. There is no satisfactory evidence of special serological types being associated with disease nor with epidemic prevalence of influenza.
5. The serological diversity of influenza bacilli cannot be used as an argument either in favour of or against their etiological relationship to influenza.

ROYAL MEDICAL BENEVOLENT FUND.

AT the meeting of the Committee held on Tuesday, July 11th, 1922, 23 cases were considered and £273 voted to 20 applicants. The following are a few of the cases relieved:

Widow, aged 40, of L.R.C.P. and S.Edin. who died from pneumonia in February last. She is left with two boys, aged 9 and 6 years. From February she has earned £9 9s. from fees for teaching piano and singing, and has received £25 10s. from investments. When the estate is realized applicant expects an income of £150 to £200 a year. She asks for assistance towards the education and keep of the two boys. Voted £2, and the case referred to the Royal Medical Benevolent Fund Guild.

Widow, aged 68, of L.R.C.P. and S.Edin. who died in 1893. She suffers from ill health and failing eyesight. She has no income now, and is living with a widowed daughter who has to maintain herself and her two children. Voted £18 in twelve instalments.

Daughter, aged 61, of M.D.Edin. Had to give up dressmaking business owing to ill health and want of money. Applicant's eyesight is bad and she can only work two or three hours at a time. Voted £18 in twelve instalments.

Daughter, aged 42, of L.R.C.P.Lond. who died in 1901. She has phthisis. At present she is a lady help at a small salary as she is not strong enough to do much work. Voted £18 in three instalments.

Subscriptions may be sent to the Honorary Treasurer, Sir Charters J. Symonds, K.B.E., C.B., F.R.C.S., at 11, Chandos Street, Cavendish Square, London, W.1.

British Medical Journal.

SATURDAY, AUGUST 26TH, 1922.

'THE WRONG TURNING IN PUBLIC HEALTH."

It is curious to note how the present financial stringency is influencing current literature on public health. Without doubt it was constantly present to Sir George Newman when he was writing his report on the state of the public health in 1921, and not less to Professor Wynne and Dr. Fremantle, M.P., when they were composing the papers they read before the Section of Public Health at the Annual Meeting at Glasgow. These papers are printed in full in this issue, and, together with Sir George Newman's report,[1] form a symposium which cannot but stimulate, though perhaps also a little bewilder, the reader anxious to clear his conception of the profit and loss account presented by sanitation and preventive medicine. Sir George Newman writes under a sense of official responsibility; Dr. Fremantle is not only a member of Parliament, but a consulting medical officer of health, and Dr. Wynne is both medical officer of health for Sheffield and Professor of Public Health in the University of that city. Each in his own way has the same purpose at heart—that while the country shall get the best possible return for its expenditure, and unprofitable outlays shall cease, there shall be no panic discontinuance of work making for communal welfare.

It is the last-named object that Dr. Fremantle has specially at heart. He demonstrates by a series of propositions and calculations that sickness and disablement are immensely costly to the nation. Under the Insurance Act in England and Wales the time lost by the employed male population in the year 1921 was equivalent to a year's work of 178,000 men. He accepts Farr's conclusion that the total number of sick throughout any year is about double the deaths occurring in the year, and this figure applied to 1920 would give a total of over 900,000 sick and disabled. Under this heading he calculates the loss at £50,000,000 per annum. Care and treatment in institutions must cost, roughly, another £50,000,000, while treatment and maintenance of home cases would add a further heavy burden. After allowing for various deductions, he estimates the total direct material loss to England and Wales from sickness and disability at £150,000,000 a year. Taking note of the reduction of death rates in sixty years, he calculates, roughly, that the money saved thereby is over £62,000,000 a year. But the life-table expectation of the working period beginning at 20 years—the age of productive labour—has increased by 10 per cent. in the seventy years ending 1912, and as the national income from personal services is reckoned at two thousand million pounds, the 10 per cent. increase means two hundred millions a year. The elimination of tuberculosis, if it were possible, would, on a conservative calculation, add over ninety millions a year from personal services to the national income. In the United States the estimated loss of wealth from tuberculosis is £100,000,000 a year; the total cost of sickness and deaths is about six times as much, and one-third of it is regarded as preventable.

Dr. Fremantle wisely concludes his paper on a note of warning. "Many measures," he says, "put forward in perfect good faith by experts and by the public are not yet sufficiently substantiated to merit their adoption as 'effective.' Many are advocated too much from the standpoint of those who seek to raise the material comfort of the workers out of the Exchequer. While improvement of feeding and of other social conditions may be expected to diminish tuberculosis and improve health, it might have a precisely contrary effect if the method adopted were to undermine initiative, moral, and personal care of the individual."

Professor Wynne, in his paper with the striking title, "The wrong turning in public health," has been thinking on different but parallel lines. For him the wrong turning was taken when ideals of prevention were allowed to be obscured by solicitude for the treatment of individuals already diseased. His argument may, we think, be briefly stated to be that the chief cause of communal disease is poverty, that poverty is increased by waste and excessive taxation, and that, therefore, every penny spent on public health, on education, or any other object admirable in itself, is waste if not justified by results. Waste, he contends, is enormously multiplied when individuals are dealt with instead of their periphery. Endless committees and national councils are created and much energy expended, but Dr. Wynne finds a rather cynical consolation in the thought that the money they waste would otherwise be wasted on something else. He is on sure ground when he maintains that popular clamour for eleemosynary schemes should be resisted, and enthusiasm guided by expert criticism. Public opinion would not tolerate refusal to finance any proposal certainly useful, but at present money is lavished on schemes of which it cannot be said that this is true

Professor Wynne demurs to Sir George Newman's dictum that "the centre of gravity of public work must swing more and more from the environment to the individual," though he is ready to admit that national health insurance, maternity and child welfare, school medical work, free treatment of venereal disease, are all laudable in intention, but directed to the individual, whilst the whole of our housing schemes broke down for want of money, and slum conditions are engendering diseases in quantities "which our breathless efforts at dealing with end results are powerless to overtake." The old ways—improvements of environment—were better. But when unduly depressed by such thoughts Dr. Wynne finds consolation in reports showing that conditions in Sheffield were much worse in 1846. He describes them vividly, and, coming to recent times, he admits that in the decline of infant mortality since 1870 "the individualistic school of public health has its greatest triumph." Ingeniously, however, he claims that as the child's environment is its mother, infant welfare is after all environmental, whilst formerly the management of infants was a "tradition expounded by the handy woman and her colleague the lady next door," and after the child was weaned (here we are again driven to quotation) "the only available food was the emulsion of cowdung and house-flies known as fresh milk." Of tuberculosis he says that the whole administration is "a classic example of the ill effects of neglecting environment in favour of dealing with the individual," and he declares his disbelief in the assertion that training inculcated during three months in a hospital or sanatorium would neutralize the increased opportunity of subsequently disseminating the disease during the slight prolongation of life when the patient returns to his home. When open-air treatment and sanatoriums were boomed there was "an outbreak of 'national societies,'" which demanded immediate provision of sanatoriums for all, "and this to a great extent was done" at a time when there was money to burn. But now we are, Dr. Wynne avers, spending some ten millions a year "when there is no money available for the elimination of the insanitary areas, where we cultivate more tuberculosis in a week than all the sanatoriums could house in a year."

[1] See page 323 of our issue of last week, and page 387 of this week.

Next, as to the school medical service, he urges that "the number of cases of disease treated in one generation will not lessen the number of defects in the next," whilst the admitted improvement in personal cleanliness (which is much less in districts known to Dr. Wynne than Sir George Newman claimed in 1917 for London, Torquay, and Carlisle) "is something imposed upon the parents by the authority, not emanating from themselves, and therefore not indicating an advance in civilization." He regrets that the Ministry's chief medical officer, who was deeply impressed with the importance of environment in 1917, wrote in 1920 that "the school medical service finds its fulfilment only in the service it can render to the individual child." But his own early experience of publishing an accurate survey of the sanitary conditions of the schools in his area taught him how painful this subject would be to "educationists."

His general conclusion is that "we have turned away from the ideals of the Public Health Act" long before environmental work was completed, and "that we are bleeding the taxpayer and the ratepayer by expenditure that does not give an adequate return in improved health and prolonged life; that we are undermining responsibility by providing services at the public expense which should be paid for by the individual, and incidentally depriving the private practitioner of a large part of his legitimate opportunity of exercising his calling." Professor Wynne has, in fact, delivered in terse and vigorous terms a bold attack on many aspects of latter-day policy in health administration. No one can refrain from sympathizing with some of his regrets and aspirations. He longs for a strong housing policy, and so do we all. It is not necessary to contest his view that the money spent on the treatment of cases of tuberculosis would have yielded a richer harvest if it had been devoted to the clearing away of slums and their substitution by good healthy dwellings. Neither, for the present purpose, need it be denied that disappointment has damped the hopes and the enthusiasm of any who made the largely erroneous assumption that because tuberculosis is an infectious disease it could be successfully controlled by the isolation and institutional measures which have, on the whole, been so valuable in the case of the acute zymotics. Whether Professor Wynne is right in holding that even three months' sanatorium treatment does not accomplish Sir Arthur Newsholme's purpose of educating the tuberculous patient against spreading infection when he returns home we do not pause to discuss. But, be the school of infectionists right or wrong, we do not think any of them would admit that the demand for "sanatoriums for all" has even yet been met, nor is there any probability, under existing conditions, that it ever will be met. Is it not far more probable that the money, had it been devoted with business economy to housing schemes, would have given better results?

This brings us to the consideration of a very essential political question. Supposing not a penny had been spent on tuberculosis dispensaries or sanatoriums, farm colonies, domiciliary treatment, or after-care, would the money so saved have been devoted to housing? Would the price of the box of spikenard ointment have been given to the poor? Was the country alive to the need for housing reform? Professor Wynne writes graphically of the despair and indignation which seize the health officer to-day when he visits insanitary property and realizes the acquiescence in squalor and filth displayed by the present generation. It is all too true; but has it not been at least equally true at any time since the present public health service began? Neither house owners, nor rent payers, nor local health authorities realized in the past the importance of thorough housing reform. When the country was wealthy it would not open its eyes; now they are open it is poverty-stricken. When, two or three years ago, the politicians and the press and the public outvied each other in their shoutings for houses, what was the result? The Government took up the matter, and with the enthusiastic support of builders and brickmakers and bricklayers entered on a course of reckless extravagance, which was brought to a stop when the nation came to realize that this was a post-war method of fleecing it, such as had hardly been surpassed by the great army of profiteers during the war itself. Straightway prices began to fall, and now houses can be built for half, a third, or even a fourth of what the country had to pay for grandiose schemes which played into the hands of extortionists. Dr. Wynne's own well-recounted experience with regard to schools illustrates another phase of the same question. The "educationists" were not ready for new school buildings, so he desisted, and has advised others similarly, but surely it was right to institute school medical inspection even in defective buildings. The fact is that a public official cannot usefully go too far in front of his controlling authority, local or central; if he does he runs the risk of acquiring the reputation of an amiable visionary, and will accomplish nothing. Dr. Wynne says that increased personal cleanliness of children "imposed upon the parents" does not indicate an advance in their civilization, but what would he have? Should the children of uncivilized parents be allowed to remain verminous (and so infect the offspring of the civilized) until the fathers and mothers learn—if ever they do—to appreciate cleanliness for its own sake? Will not the children by the very imposition on them of cleanliness be civilized in that respect and be the means of civilizing the next generation?

But let us not be misunderstood. We rejoice in Professor Wynne's brilliant attack, and enjoy his hyperbole, as in that entertaining description of fresh milk already quoted. In particular he is right—and here he is in entire agreement with Dr. Fremantle, and has also the sympathy of Sir George Newman—in insisting that there should be the most strenuous avoidance of the sapping of personal and parental responsibility by the bestowal of gifts of food and milk and medicines, unless in cases of the most absolute necessity. Here, indeed, is a real danger, and the Americans are becoming alive to it as well as ourselves. Education of mothers in the nursing of their babies and the rearing of their children is excellent, but when it is avoidably supplemented by doles in money or in kind it is to be condemned. Government grants in aid of local authorities have two sides—an evil and a good. The evil side is that they foster the vicarious benevolence of sloppy sentimentalists everywhere, who argue that as only a half or a quarter of the cost falls on the local rates, and the rest is obtained from the national purse, there need be no hesitation in a free distribution to all concerned of everything they can be plausibly alleged to need. That, however, opens up a wide question which cannot be entered on here.

SHELL SHOCK.

IN our last issue (p. 322) we published a summary of the Report of the War Office Committee of Inquiry into Shell Shock. As we then said, it is a document which will appeal to a wider circle of readers than those comprised within the medical and military professions. The report is unanimous, and this somewhat unusual result of an inquiry on a subject which has aroused a great deal of public attention ought to enhance the value of the conclusions reached. Whatever may have been the immediate motives that led the Government to institute the inquiry, there can be no doubt that one of the most

influential was the fact that a feeling of dissatisfaction had been expressed in certain quarters with regard to the treatment of mental disorders amongst ex-service men where the disorder was supposed to have been produced by shell shock. We seem to remember that when the Committee was appointed certain newspaper criticisms were levelled at its constitution, one being that regimental and other combatant officers were not sufficiently represented, and that there was an undue preponderance of medical members. Whatever weight there may have been in this criticism—and we are not to be understood as admitting that it had any—was compensated by the fact that among the witnesses examined by the Committee were many combatant officers, as well as some actual sufferers from the condition under consideration. The nature of the conclusions reached by the Committee, and the fact that its members were unanimous, will, we venture to hope, dissipate any feeling of the kind we have indicated.

The conclusions reached by the Committee are, indeed, identical with those generally reached alike by medical observers and combatant officers who have had any extensive experience of shell shock, whether in patients under their care or in soldiers under their command. The very fact that the conclusions stated by the Committee are similar to those reached by those best qualified to judge may, however, possibly diminish the effect of the report on those members of the general public whose indiscriminate sympathy with the victims of so-called shell shock has done much to perpetuate their condition. When we come to examine carefully the Committee's recommendations and conclusion, it is significant to find that the very term "shell shock" is whole-heartedly and unanimously condemned. The number of cases which could be held to be due to actual concussion from the results of shell explosions were found to form a very small proportion of the total; the proportion is variously stated by different witnesses, but no witness puts it higher than 10 per cent. of the total number of cases from all causes. From the facts and evidence before it the Committee concluded that by far the greatest number of cases are produced by emotional disturbances, to which the effects of fatigue and the general nervous and mental exhaustion induced by strains and hardships of every kind are rightly held to have contributed. The particular kind of emotional disturbance principally to blame is naturally that of fear. The evidence of all observers, especially of those whose duty kept them in or near the front line, is unanimous on this point. To the emotion of fear is added the mental conflict naturally engendered between that emotion and the rival forces of discipline and moral. A third group of cases consists of men suffering from definite mental disorder. The attempt of some members of Parliament, backed up by certain newspapers, to make capital out of the fact that ex-service men have been and are being treated in asylums, received no support from the evidence of witnesses, military or medical, who were closely examined on the point; nor is it countenanced by the Committee, whose conclusions it may fairly be hoped will do something to alleviate any public anxiety on this score. One very eminent authority, indeed, went so far as to say that "the war created nothing in the way of psychoses," and another stated that those service patients who were still in asylums and whose histories he had been able to follow, were nearly all suffering from dementia praecox.

The immense importance of the condition loosely termed "moral" in the prevention of shell shock was emphasized again and again in the evidence given by combatant and medical officers alike, and the Committee wisely points out how moral can be fostered by careful training and discipline. The very great practical difficulty in distinguishing between shell shock and actual cowardice was discussed by several witnesses, who showed themselves fully alive to its importance. In civil life it is often far from easy to decide in certain cases between hysteria and malingering; in the field similar difficulties are encountered when men are charged with cowardice. Unfortunately the Committee has done little to enlighten or guide us on this matter, and we gather that in actual practice it often became impossible to rebut a defence of shell shock.

As was to be expected, some divergence of opinion emerged with regard to the merits of the various methods of treatment, but one of the main conclusions reached is that it is better to keep such cases as far as possible in the divisional areas; men invalided away from a war area and retained for long in hospitals at home rarely recovered sufficiently to return to the line. Much harm was done also by the frequent transfer of men from hospital to hospital, a policy which made continuity of treatment impossible. While the great value of psychological treatment is recognized the weight of opinion is not in favour of the Freudian method of psycho-analysis; emphasis is laid rather on the therapeutic advantages of occupation and re-education.

Methods of recruiting and the deficiencies of the British system, both in peace and war, receive full consideration in the report, and the Committee has provided some valuable suggestions in regard to the principles of training. Though consideration of the problem of the shell-shock pensioner may not have been directly included in the reference to the Committee, yet we could have wished that an opinion on this thorny subject had been expressed.

We may hope that the recommendations of the Committee on prevention and treatment will be carefully studied and will become a part of the special education of officers in the navy and army, both medical and executive. It is to be desired, also, that in the deplorable event of another struggle between the nations the inevitable problem of the future pensioner may be borne in mind by recruiting authorities, and every care taken to avoid the reappearance of the difficult problem with which the nation is now confronted.

THE CALCUTTA SCHOOL OF TROPICAL MEDICINE, 1921.

UNDER the endowments given by the Indian Tea, Jute, and Mining Associations (at the suggestion of Sir Leonard Rogers) for the investigation of diseases affecting the health of their labour forces important researches have been carried out at the Calcutta School of Tropical Medicine, and are briefly recorded in the report for 1921 which has recently been issued. Dr. L. E. Napier, who has been investigating kala-azar, which is still affecting some tea estates in Assam, has attempted to infect animals and to transfer the infection from one to another by biting insects, but so far without much success. He succeeded in infecting two monkeys (*Macacus rhesus*) by intravenous injection of 10 c.cm. of an emulsion of a kala-azar spleen; they developed only a very mild infection, which produced no symptoms and disappeared within a few months; it is not surprising therefore that the insect-carrying experiments gave negative results. Much work has also been done at diagnostic blood tests for kala-azar, the globulin precipitation test and the haemolytic test proving of no practical value. On the other hand, a new aldehyde test described by Napier has furnished valuable results: 1 c.cm. of the serum of the patient is placed in a small test tube, and one drop of commercial formalin is added; if the case be one of kala-azar the serum becomes solid and opaque like the white of a hard-boiled egg in from three minutes to two hours; 83 of 90 kala-azar cases verified by spleen puncture gave positive results, while only 1 of 60 cases negative on spleen puncture was positive to the test. Much work has also been done on the treatment of the disease by antimony salts, and

an important advance has been made in the discovery that a 2 per cent. solution of a chemically pure scale preparation of sodium antimony tartrate can be injected intramuscularly with only slight temporary pain and no inflammatory reaction. Five cases in children, all under the age of 7, in whom repeated intravenous injections are very difficult, have been cured by this method. If on further experience the plan proves feasible on a large scale, it will make it much more easy to stamp the disease out of infected districts than is the case at present. Dr. J. B. McVail, in his report on the work of the hookworm research laboratory, deals first with the finding of ankylostoma eggs in stools; for this purpose Lane's levitation method gave the best results, although a simpler plan, requiring less apparatus, has been worked out in the laboratory and adopted for routine work. About half a gram of emulsified stool is allowed to stand for ten minutes on a slide between grease pencil marks; it is then gently immersed in water to float off the débris and examined under the microscope; in this way even mild cases can be quickly diagnosed by finding the ova. The effect of various conditions and chemicals on cultures of the larvae has been tested; a temperature of 90° to 96° F. prevented all development, but the septic tank, even with 1 in 400 chlorinated disinfectant, failed to do so; wet sand seven inches thick was traversed by active larvae in a week. They can penetrate wet clothing and even wet shoe-leather, although boiled linseed oil will protect the latter against them. Methods of treatment have been tested to find the most suitable plan for dealing with a large, apparently healthy, labouring population as out-patients. It was found that three treatments, at seven to ten days' intervals, with 30 minims in three equal doses at hourly intervals, commencing one hour after a meal without any preliminary purge, removed 98.2 per cent. of the worms; the sample was previously tested to ensure that it was non-toxic. The wholesale cost of the full course is 4d. per patient. The plan should make it possible greatly to improve the health and working powers of labourers in Lower Bengal, where 80 per cent. are infected. Both inquiries were handicapped during 1921 because the Carmichael Hospital for Tropical Diseases was not opened until December. Much good work was, however, accomplished, and the progress of this important experiment in the endowment of medical research in the tropics by the large employers of indigenous labour must be pronounced to be very encouraging.

THE MAUDSLEY HOSPITAL.

THE renovation of the Maudsley Hospital after its service as a military hospital during the war and subsequently as a neurological centre under the Ministry of Pensions has now been completed, and the hospital is equipped for its original purposes—namely, the early treatment of cases of acute mental disorder, the promotion of exact scientific research into the causes and pathology of insanity, and the clinical instruction of medical students. At its last meeting before its summer recess the London County Council decided that, at any rate at the beginning of its work, the hospital shall be entirely dissociated from certified lunacy. Cases under certificate are not at present to be received, and if possible there is to be no certification in the hospital either for retention or transfer. This will involve making arrangements for speedy removal by relatives accepting responsibility, and possibly arrangements with Poor Law authorities when this responsibility is not discharged. This will mean the exclusion of some cases of the most suitable class for teaching and for treatment to recovery, and until legislation is introduced to provide for the reception without certification of certifiable cases, the work of the hospital will be seriously hampered. The Council has decided to make representations to the Government that such legislation should be hastened. The Maudsley Hospital has in-patient accommodation for 157 persons. One ward on each side of the hospital is set aside for acute cases. The staff will consist of the medical superintendent (Dr. E. Mapother), a deputy medical superintendent, a senior assistant medical officer, and two assistant medical officers. The remuneration of these four members of the assistant medical staff will be respectively £650, £450, £350, and £300 on pre-war economic conditions, and for one of the junior appointments women candidates will be eligible. No definite proposal has been submitted with regard to clinical assistants; it is thought that they may be obtained without payment when the hospital is in being, but they will be engaged so as to afford them opportunity for the study of psychological medicine, and not with a view to avoiding the appointment of necessary staff. The medical superintendent proposes that junior assistant medical officers of the London mental hospital service should be seconded for service at Maudsley Hospital as part of the course for the diploma in psychological medicine. The appointment of assistant medical officers will be subject to review at the end of each year of service. The services of certain consultants will be retained, and for these and for dental services a sum of £500 a year will be provided. The nursing staff will consist of a matron, assistant matron, seven sisters, 18 female staff nurses, 23 female probationer nurses, and 12 male probationer nurses. Cases will be admitted principally through an out-patient department and through Poor Law institutions, the medical officers of which will be asked to notify what appear to be suitable cases with a view to such cases being interviewed by one of the hospital medical staff; another source of admission will be cases seen privately. The out-patient department is to be opened, if possible, in advance of the wards; the letter of a doctor or similar recommendation will be required, except in the case of an ex-patient of a London county mental hospital. Patients in a position to do so will pay a moderate sum. Facilities will be given for the admission of poor people, so that there may be no suggestion that the hospital is reserved chiefly for paying patients. The cost of maintenance of the whole hospital, with the full complement of staff and patients, will be £37,500 a year, but it is expected that part of this will be recouped by patients' payments. It has been arranged to retain the services of Sir Frederick Mott, who was due to retire on October 23rd, until March 31st, 1923, so that the Council may have the advantage of his advice in connexion with the scheme for the administration of the Maudsley Hospital. After March 31st his services are to be retained for a further six months in an advisory capacity at a remuneration to be determined.

A CENTENARY OF SIR CHRISTOPHER WREN.

SIR CHRISTOPHER WREN (1632–1723) has for the medical profession a double interest—general and special—over and above that which every educated man must have for his outstanding genius. In the first place, early in his life, before he entered as an undergraduate at Oxford, he assisted Sir Charles Scarburgh, physician and mathematician, in making and demonstrating anatomical preparations and in various experiments for his anatomical lectures at Surgeons' Hall. Wren, like his early master, was one of the original Fellows of the Royal Society—in fact, his rooms at Gresham College, where he was Professor of Astronomy, served as a meeting place for those who subsequently founded the Royal Society. Another point of general medical interest is that when 21 years old Wren executed a number of elaborate drawings which appeared in Thomas Willis's famous "*Cerebri Anatome Nervorumque Descriptio et Usus*" (1664). The special and somewhat restricted point of interest to the medical profession is that Wren was the architect of the third home of the Royal College of Physicians of London, that in Warwick Lane, Newgate Street (1679–1825), with its fine theatre erected at the expense of Sir John Cutler, a City merchant, who was an example of that not unknown combination of "petty personal parsimony" and large benevolence and public spirit. This theatrum Cutlerianum was described in James Elmes's memoir of Sir Christopher Wren as "a perfect study of acoustical and optical architecture," an example, it may be added, that might be more constantly imitated in some modern buildings. Sir Christopher Wren died on February 25th, 1723, and accordingly the Royal Institute of British Architects is making arrangements for a commemoration week beginning on Monday, February 26th

next. It has formed a "grand committee," on which, it is hoped, representatives of appropriate Government departments, the great artistic, scientific, and archaeological societies, and the universities will serve. It is therefore fitting that the medical profession should take part in this bicentenarial commemoration, and at the request of the Royal Institute of British Architects the Royal College of Physicians recently appointed Dr. R. Dawtrey Drewitt as its representative on the grand committee. It is proposed to organize a procession from the Mansion House to St. Paul's Cathedral, where a memorial service will be held and a visit made to the crypt, when the President of the Royal Institute of British Architects will lay a wreath on Wren's tomb. There are, it may be mentioned, two other memorials in the cathedral to its great architect, one being the well-known inscription over the door of the north transept, which directs the visitor who desires to see a memorial to Wren to look around. On the evening of this day a meeting of the Royal Institute of British Architects will be held for the reading of papers on the life and work of Wren, and an exhibition of his drawings, manuscripts, and relics will be on view for several days at the house of the Institute in Conduit Street. A pageant illustrating his times is to be arranged, and visits are to be paid to the buildings erected under his direction.

THE FATAL CASES OF FOOD POISONING AT LOCH MAREE.

PUBLIC attention has been very forcibly directed to the subject of food poisoning by the tragic occurrences last week in an hotel at Loch Maree, Gairloch, remotely situated in Rossshire, where eight persons have died with symptoms suggestive of botulism. According to the information at present available the facts seem to be as follows: On Monday, August 14th, a number of persons staying in the hotel started on fishing or walking expeditions and took sandwiches with them. Some of these sandwiches were made with meat paste, and it appears that only those who consumed these potted meat sandwiches suffered. The sandwiches were eaten for lunch on August 14th by eight persons, and the earliest symptom, diplopia, was observed in one of them before breakfast on August 15th, so that the shortest interval between ingestion of the sandwiches and the development of the earliest symptom was about eighteen hours. The seven other persons affected began to suffer during the course of August 15th; two, both of them ladies, died on that day; the others were men—two died on August 16th, two on August 17th, and two on August 21st. In addition to diplopia, which seems in all instances to have been the first noticed, the symptoms mentioned are ptosis, dizziness, paralysis and feeling of constriction of the throat, vomiting and collapse. Vomiting, however, does not appear to have been a marked feature, and no mention is made of diarrhoea. These symptoms do not resemble those of food poisoning due to one or other of the members of the Gaertner group of bacilli, but are like those produced by *B. botulinus*, an anaerobic organism which causes the disease known as botulism. This name was given to the disease in Germany, where the first cases were observed, because they were traced to the eating of certain sausages (*botulus*, a sausage). A few years ago Dickson, in a report to the Rockefeller Institute for Medical Research,[1] stated that *B. botulinus* could exist in material not containing any animal protein; he detected it in canned vegetables and fruit. Cases have been reported within recent years in California, where the disease was thought to be due to the eating of olives, or french beans, preserved in cans or bottles. In an outbreak in Idaho, mentioned not long ago in our columns (June 3rd, 1922, p. 893), six persons died after eating greens which had been canned at home. The early symptoms in these cases included dizziness, blurring of vision, and unsteady gait, followed by vomiting; later, blepharoptosis, paraesthesia of the extremities, weakness of the arm, leg, and especially neck muscles, dyspnoea, dysphagia, and aphonia were noted. Dilatation of the pupils was observed and was accompanied by sluggishness of the light reflex; Babinski's sign was present, and the knee-jerks were exaggerated. The organism which causes botulism is destroyed by boiling. It has been isolated and an antitoxin has been prepared, but so far little benefit appears to have been derived from its administration in man, although animal experiments have encouraged perseverance in its use. So far as we can ascertain no other form of treatment has been proved to be of any avail in botulism. In the north of Scotland a fatal disease has recently occurred among horses, and it has been stated that the symptoms resemble those of botulism. Fortunately, portions of the suspected meat paste have been secured. It is stated to have been supplied originally by a large firm of manufacturers, and it is possible that the infection arose locally in some way as yet unexplained. As soon as the fact that an outbreak of food poisoning had occurred became known the Scottish Board of Health dispatched medical officers to the spot, and Dr. Dittmar, one of its medical inspectors, was able to obtain first-hand information from medical men on the spot, among whom were included several visitors on holiday in the neighbourhood. A public inquiry will no doubt be held, although the exact form it will take had not been settled on August 22nd. The Lord Advocate has power under the Scottish Accident and Sudden Deaths Enquiry Act to order a public inquiry into any case of sudden or suspicious death in Scotland. The Scottish Board of Health would also have power to hold a public inquiry; whatever the final decision on this point may be, there can be little doubt that the most important evidence will be with regard to the results of the bacteriological inquiries now being carried out. The outbreak was first reported in the lay press as "ptomaine poisoning," a term which had its origin in a theory soon proved to be erroneous, and long ago abandoned by the medical profession. Outbreaks of food poisoning are due to infection. If the outbreak is one of botulism, it is, we believe, the first that has occurred in Great Britain.

[1] BRITISH MEDICAL JOURNAL, 1918, vol. ii, p. 693.

MEDICAL SCIENCE IN NEW ZEALAND.

IN the *Proceedings of the University of Otago Medical School*[1] for 1922 there have been collected in one volume some fourteen recent articles by members of the school, first published chiefly in the *New Zealand Medical Journal* and the *Transactions* of the New Zealand Institute. They cover a wide field, and show that a high standard of scientific research and clinical work is being attained in Dunedin. The editor of the volume, Dr. D. W. Carmalt Jones, who is professor of systematic medicine in the University, contributes an interesting article on the meaning of the word "symptom," and also shorter notes on amoebic dysentery, on two cases of peripheral neuritis, on syphilis of the nervous system, and (with Mr. J. Renfrew White) on two cases of laminectomy. Professor W. P. Gowland writes on the surgical anatomy of the thyroid gland, Dr. J. W. Hall on diabetes mellitus, Professor L. E. Barnett on hydatid thrill, Dr. A. P. Marshall on the selection of an anaesthetic, and Professor A. M. Drennan on aneurysms of the larger cerebral vessels. Dr. A. J. Hall and Dr. E. H. Williams contribute short notes on cystic disease of the accessory sinuses and on diaphragmatic hernia respectively. The physiological action of tutin—the active principle of the tutu plant, which has had an unenviable notoriety in New Zealand as a poisoner of sheep and cattle from the days of the earliest settlers—is reviewed by Dr. Frank Fitchett and Dr. John Malcolm, and Mrs. Dorothy E. Johnson examines the food values of New Zealand fish. The fact that the numbering of the pages of each reprint is independent will cause some difficulty to those who may wish to quote the articles, and this defect should, if possible, be remedied in any future issues of the *Proceedings*. Professor Carmalt Jones and the University of Otago are to be commended for their enterprise and their achievement.

[1] *Proceedings of the University of Otago Medical School, 1922.* Dunedin, New Zealand.

THE JUNIOR RED CROSS.

THE July issue of the *World's Health*, a monthly magazine issued from Geneva by the League of Red Cross Societies, is devoted mainly to an exposition of the history and organization of the Junior Red Cross and to advocacy of its international extension. Its objects are to inculcate in the children of the country where the movement is adopted "the ideal and practice of service, especially in relation to their own health and that of others, the understanding and acceptance of civil responsibility, and the cultivation and maintenance of a spirit of friendly helpfulness to children in all countries." The basic purposes of the League of Red Cross Societies itself are "the improvement of health, the prevention of disease, and the mitigation of suffering throughout the world, and to secure co-operation for these purposes." Naturally it will occur to the reader to ask what may be the relation of this excellent scheme to the Boy Scout and Girl Guide movement, and it is satisfactory to learn that the Junior Red Cross is believed to make for solidarity among all the organizations of Youth. In various countries groups like Boy Scouts have found Red Cross aims entirely in accord with their own. In the United States membership of the Junior Red Cross is regarded as part of the training for citizenship and helps to recruit adult members for the Red Cross. Teachers play an important part in the Junior Red Cross. Many of them have found it an ideal instrument for influencing the young generation aright. A specimen plan of organization is given, but it is a principle of the whole scheme that in different countries divergences of method are not only necessary but desirable, as every variety of experiment has its value. The cost of junior membership may often at first have to be met by the national organization concerned, but the real benefits of it are obtained when the juniors have become adults. Also it is a humanitarian work for which the resources of a national Red Cross Society may be considered available, though it is better that at least part of the administrative costs should be borne by the juniors themselves. Members may be enrolled either by classes or by groups. Overlapping with other organizations being avoided, the scheme has every appearance of being a valuable addition to the voluntary agencies which do so much to supplement the activities of public departments, whether State or rate supported.

ANIMAL EXPERIMENTS IN 1921.

THE annual return showing the number and nature of experiments on living animals during the year 1921[1] gives a list of all "registered places" where such experiments may be performed, the names of all persons who hold licences during 1921, together with the registered place for which the licence was in force and the number and nature of experiments performed. In the year 1921 twenty new places were registered for the performance of experiments and thirteen places were removed from the register. The total number of licensees was 812, of whom 219 performed no experiments. The experiments may be divided into two main groups, according to whether or not an anaesthetic was used. It should be noted that the granting of a licence only permits the licensee to perform experiments under an anaesthetic, for the law declares "the animal must, during the whole of the experiment, be under the influence of some anaesthetic of sufficient power to prevent the animal feeling pain; and the animal must, if the pain is likely to continue after the effect of the anaesthetic has ceased, or if any serious injury has been inflicted on the animal, be killed before it recovers from the influence of the anaesthetic which has been administered." To perform other experiments or even to observe the subsequent course of experiments undertaken with an anaesthetic the licensee must be possessed of special certificates. Special certificates are also necessary for experiments on dogs, cats, horses, asses, mules, and other large animals. The total number of experiments with anaesthetics was 8,165, and of these 2,053 were simple inoculations into the skin of guinea-pigs, which were anaesthetized in order to keep the animals motionless during the introduction of a minute quantity of the fluid to be tested for the purpose of standardization. Of the remaining 6,112 experiments, comprising all the cases in which any serious operation was involved, 2,751 were performed under the licence alone, and were subject therefore to the restrictions above mentioned. In all operations, with the exception of a few special cases dealing with the efficiency of antiseptics, the law demands that the operation shall be performed antiseptically so that the healing of wounds shall, as far as possible, take place without pain. If the antiseptic precautions fail, and suppuration occurs, the animal must be killed. The following "pain condition" is attached to the licence under special certificates: "If an animal, after and by reason of the said experiments, is found to be suffering pain which is either severe or is likely to endure, and if the main result of the experiment has been attained, the animal shall forthwith be painlessly killed. If an animal, after and by reason of the said experiments, is found to be suffering severe pain which is likely to endure, such animal shall forthwith be painlessly killed, whether the main result of the experiment has been attained or not. If any animal appears to an inspector to be suffering considerable pain, and if the inspector directs such animal to be destroyed, it shall forthwith be painlessly killed." The total number of experiments without anaesthetics was 67,097. These were mostly simple inoculations and hypodermic injections, but included also some feeding experiments and administration of various substances by the mouth or by inhalation or by external application, and the abstraction of blood by puncture or simple venesection. In no instance was a certificate dispensing with the use of anaesthetics allowed for an experiment involving a serious operation. The total number of experiments was 75,262, being 4,895 more than in 1920. The objects for which these experiments were performed were very diverse. A large number, almost wholly simple inoculations, were performed either on behalf of official bodies, with a view to the preservation of the public health or directly for the diagnosis and treatment of disease. Experiments conducted at a sewage farm to test the character of the effluent by its effect on the health of fish is an example of work carried out for the preservation of public health. Nearly 20,000 experiments were performed for the preparation and testing of antitoxin serums and vaccines and for the testing and standardizing of drugs. The several registered places were visited frequently by the inspectors, usually without previous notice, and they report that the animals were suitably lodged and well cared for, and the licensees generally attentive to the requirements of the Act and the conditions attached to their licences.

[1] *Experiments on Living Animals.* Return for 1921. London: H.M. Stationery Office (to be obtained through any bookseller), price 1s.

MAN'S INSECT ENEMIES.

WE have received a copy of an address entitled *Man's Insect Enemies* which was delivered last May to the undergraduates of the University of Hong-Kong by Dr. Francis Clark of London, formerly professor of medical jurisprudence and dean of the Faculty of Medicine. Dr. Clark pointed out that while the treatment of disease was a matter solely for trained physicians and surgeons, the prevention or avoidance of disease vitally concerned the whole community, and was worthy of study by everyone. He went on to deal with the more important diseases conveyed by the agency of insects. In regard to bubonic plague, he outlined the best methods of controlling the rat population, the only safe way of doing so being by reducing to a minimum their food supply by efficient scavenging, combined with the rat-proofing of buildings. He told his audience that it was in 1894, when working in Hong-Kong, that Manson suggested that the parasites of malaria, then recently discovered by Laveran, were carried by mosquitos; the truth of this was later conclusively established by Ronald Ross. Dr. Clark mentioned that in a recently published interview, Sir

Ronald Ross stated that the best work which was being done in the practical prevention of malaria had been accomplished at Khartoum, at Klang (F.M.S.), and at Hong-Kong. Turning next to yellow fever, Dr. Clark observed that the spirochaete which caused it was also conveyed by a mosquito, which bred chiefly in collections of water around houses; on this account it was important not to place the legs of the household ice chest in cups of water, as was frequently done in the tropics to prevent the access of ants to the food, but to fill the cups with kerosene. He brought a serious indictment against the common house-fly as a carrier of the infection of typhoid fever, dysentery, enteric, occasionally of cholera, and probably of several other diseases. Flies were largely responsible, he said, for the spread of the various forms of ophthalmia from man to man in tropical regions. They were agents, also, in the propagation of hookworm disease, as it was found that when fly eggs which had been laid in polluted earth developed into larvae they churned up and aerated the soil so that the hookworm eggs hatched out more readily. Dr. Clark had high hopes of the efficacy of carbon tetrachloride for the treatment of hookworm disease, as recent information from Fiji was to the effect that even a single dose might free the victim of 98 per cent. of the parasites. This treatment was due to a suggestion made last year by Hall, a veterinary surgeon of Washington. The methods of infection in filariasis, relapsing fever, trench fever, typhus fever, and sleeping sickness were in turn described, and preventive methods were outlined. In regard to infantile paralysis Dr. Clark said that some light had been thrown on the subject by the recent research work of certain American veterinary surgeons, for it had been shown that wry-neck, a fatal paralytic disease in poultry, was caused by an infection conveyed by a certain small fly which occurs all over the world. This suggested that infantile paralysis might be disseminated in a similar manner.

ASSOCIATION OF CERTIFYING FACTORY SURGEONS.

THE excellent work the Association of Certifying Factory Surgeons does for its members is well exemplified in the Annual Report for 1921, which has recently been issued. The Home Office recognizes this Association as representative of factory surgeons, as is shown by the account given of the negotiations with the Factory Department that resulted in a complete revision of the part of the Home Office Annual Report which deals with the examinations for certificates of fitness. Particulars are given also of a joint conference between the Chief Inspector and the Secretaries of the British Medical Association and of the Factory Surgeons' Association on the matter of fees and the necessity for medical supervision of first-aid arrangements in factories. In these circumstances it seems regrettable that the more recently appointed surgeons are not taking the trouble to become members. The report for 1921 should be sufficient to convince any factory surgeon that he will be well advised to join this special organization. The part of the report dealing with the "Future of the certifying surgeon" is very much to the point. The first paragraph definitely lays down that the only way to deal with the great amount of industrial sickness and mortality is by abolishing the unhygienic conditions of occupation, that it is an obligation on the Government to create the necessary medical supervision in the factories themselves in order to ascertain the faults and devise the remedies, and that the certifying surgeon could be made into a useful adjunct in carrying out a workable scheme. It is claimed that industrial preventive medicine is a branch of State medicine and must be taken in hand by the State if it is to prove universally effective; in support of this contention it is pointed out that the remarkable results following the introduction of the medical element into the study of specific dangerous trades were not attained without establishing statutory notifications and regulations, aided by a large amount of valuable work done by the certifying surgeon. It is considered logical to infer that machinery and methods similar to those mentioned could be utilized to prevent certain general diseases which now single out particular industries and produce heavy mortality. At the same time it is recognized that financial reasons will prevent the discharge of any State obligation in this direction for some considerable time to come. It is therefore suggested that the correct policy of the certifying surgeon is to make himself acquainted with such voluntary efforts as are being made to improve the hygienic conditions of factory employment. The certifying surgeon should carefully consider the practicability of undertaking by private arrangement, particularly in factories which he is already visiting at regular intervals, a considerable portion of what may be regarded as the essential medical supervision. The report also points out the wisdom of co-operation with welfare supervisors, and how each can render assistance to the other to the advantage of both. We are informed that any person interested can obtain a copy of the report on applying to the secretary at 40, Brazennose Street, Manchester.

NAVAL MEDICAL SERVICE MEMORIAL.

A MEMORIAL tablet to over two hundred naval medical officers and members of the nursing staff who were killed or died on active service during the war was unveiled on August 17th by Sir Robert Hill, Medical Director-General, R.N. The ceremony was attended by many relatives of the fallen and by a number of medical officers. Sir Robert Hill said he could conceive no more suitable spot in which to place the tablet than in the gateway of Haslar Royal Hospital, built in the eighteenth century, and itself a memorial to the most glorious days of English history. To Haslar Hospital were brought the sick and wounded from the battles of Copenhagen, St. Vincent, the Nile, Trafalgar, the Crimea, and the Baltic; during the great war it was filled to overflowing. Through its gateway passed every probationer surgeon, and future generations would pay their tribute to the sacrifice of their brother officers and the nursing sisters who gave their all for King and country, and left for ever an example of patriotism. Similar memorials are to be erected at Chatham and Devonport.

THE EDUCATIONAL NUMBER, 1922.

OUR next issue will be the annual Educational Number of the BRITISH MEDICAL JOURNAL. As briefly indicated last week, the usual features will be supplemented by an important introductory article on the training of the medical student, written at our request by Sir Clifford Allbutt; a note by Professor W. E. Dixon on the future of pharmacology and its place in the curriculum; a full account of the forthcoming changes in the scheme of study and examination prescribed by the new resolutions and recommendations of the General Medical Council; and a short statement of the numbers of the medical profession year by year during the past forty-five years. The customary sections, giving a summary of the requirements of the universities and other licensing bodies in Great Britain and Ireland, have been brought up to date, and the information showing the opportunities offered by the various medical schools and teaching institutions has been corrected by the authorities concerned. The Educational Number will include also articles on the public services and the medical education of women to-day, and on post-graduate study; and on some general aspects of professional study and the practice of medicine, addressed mainly to prospective students and their parents.

ITALY is taking measures to ratify the conventions of the International Labour Conference of the League of Nations with regard to women. As soon as compulsory insurance against sickness has been established all women will be entitled to six weeks' rest before the probable date of childbirth, and the provision will apply to women employed in commercial undertakings. Maternity insurance, which will affect these women, and also those employed in minor industries, will provide grants for six weeks before and six weeks after childbirth, as well as free attendance by a doctor and midwife. A bill is to be introduced to make the Italian law with regard to the employment of women and young persons at night conform with the terms of the convention.

Nova et Vetera.

BUCCANEER SURGEONS.

IN giving an account some months ago (February 18th, 1922, p. 280) of the career of Thomas Dover, buccaneer and inventor of the powder which bears his name, it was said that he rescued Alexander Selkirk, the skin-clad hero of *Robinson Crusoe*, who had been marooned on the island of Juan Fernandez. Probably, however, the credit should be given to William Dampier, who had known Selkirk long before, and, moreover, was well acquainted with the island, which he calls John Fernando's.

More than a quarter of a century earlier Dampier had taken part in the great buccaneering expedition across the Isthmus of Panama to the South Sea and after various excursions and adventures had been one of the party which returned on foot to the Caribbean Sea. Wherever he was and despite all difficulties this remarkable man seems to have kept a journal in which he noted not only daily events but descriptions of the manners and customs of the natives, of the flora and fauna, the weather and the chief physical features of the country. In his descriptions of the voyages of the buccaneers (or 'privateers, as they preferred to call themselves) there are frequent references to the surgeons, which show how much their services were valued. Thus Dampier states that on one occasion a ship's company refused to put to sea because they had no surgeon: and when "our Surgeon, Mr. Wafer," was injured "we allowed him a slave to carry his things, being all of us the more concerned at the accident, because liable ourselves every moment to misfortune and none to look after us but him."

When the buccaneers landed to attack a town the surgeons accompanied them, and it is recorded by Dampier that in an attack on an Indian town in Mexico "our surgeon and one man more were wounded with arrows." In the disastrous attack on Arica in 1680 the surgeons had occupied a church as a hospital, where they found a store of wine. Possibly this discovery accounts for the fact that they were left behind when their comrades retreated. They were, however, released by the Spaniards on their consenting to settle down to practice in the city.

In the reign of Charles II the professional education of the average practitioner in England probably consisted almost entirely of the acquirement of precepts and experience in the service of a master under the apprenticeship system. Theoretical knowledge was at a discount. Anatomy, physiology, and chemistry were then far outside the ordinary curriculum, and even seventy years later, when the practice of surgery had made great advances, Roderick Random's master is represented as preferring the knowledge of "how to bleed and give a clyster, spread a plaster and prepare a potion," to that of the causes of muscular action and the mystery of the brain and nerves.

The surgeons of the buccaneers probably worked by rule of thumb and gained their knowledge not from books, but from their masters and their own hardly won experience. The crews were probably less liable to scurvy than those of less law-abiding vessels, for they relied for food largely on such fish and turtles as they could catch, and were frequently ashore, where they got fresh vegetables and cattle. The beef they did not eat fresh they smoked and stored on board, and the name of buccaneer is said to be derived from a Brazilian word signifying "smoked meat." Yet they were not immune from scurvy, for Dampier tells us that—

> "At John Fernando's our sick men were ashore all the time" (sixteen days) "and one of Captain Eaton's Doctors (for he had four in his Ship) tending and feeding them with Goat and several Herbs, whereof here is plenty growing in the Brooks: and their diseases were chiefly Scorbutick."

No wonder it was thought worthy of record that in a certain prize they took seven or eight tuns of marmalate of quinces, for marmeloes or quinces had been recommended fifty years earlier by Captain John Smith in his *Accidence, or the pathway to experience necessary to all Young Seamen.*

One of the buccaneer surgeons, the Lionel Wafer above mentioned, left an account of his experiences in *A New Voyage and Description of the Isthmus of America*, London, printed by James Knapton, at the Crown, in St. Paul's Churchyard, 1699. It is not known where he was born, but he appears to have been an Englishman with some knowledge of Scotland and Ireland. His first voyage, "being then very young," was made "in the Service of the Surgeon of the Ship" to the Strait of Malacca in 1677. Two years later he went in a similar capacity to Jamaica, where for some time he practised surgery, but falling in with two privateering captains there he was tempted to try his fortune with the buccaneers, and after some adventures on the Atlantic coast of Central America he crossed the isthmus with Dampier and others under the command of Captain Bartholomew Sharp. In the Pacific he went as far as Juan Fernandez and Drake's Island, but after various adventures on sea and on shore he and Dampier joined the party of some fifty men who were dissatisfied with Sharp's leadership, and in a ship's longboat and native canoes started to return to the isthmus and recross it on foot to the Caribbean Sea. On the fifth day of the journey Wafer was disabled. The accident is best described in his own words:

> "I was sitting on the ground near one of our Men, who was drying of Gunpowder in a Siver Plate. But not managing it as he should, it blew up and scorched my Knee to that degree, that the Bone was left bare, the flesh being torn away, and my Thigh burnt for a great way above it. I applied to it immediately such Remedies as I had in my Knapsack: And being unwilling to be left behind my Companions, I made hard shift to jog on, and bear them Company for a few days; during which our slaves ran away from us, and among them a Negro whom the Company had allowed me for my particular Attendant, to carry my Medicines. He took them away with him, together with the rest of my Things, and thereby left me deprived of wherewithal to dress my Sore; insomuch that my pain increasing upon me, and being not able to trudge it further through Rivers and Woods, I took leave of my Company, and set up my Rest among the *Darien* Indians."

To this accident we owe the interesting account of the Indians which Wafer has given. At first he and his four companions were objects of some suspicion at the Indian settlement and were rather roughly treated, although, as he says, "Not that they were naturally inclin'd to use us thus roughly, for they are generally a kind and free-hearted people." When, however, the natives heard of the good treatment which some of their fellows had received from Dampier and his party they became kind and hospitable. The Darien Indians seem to have been generally well disposed towards the English, partly because they hated the Spaniards, with whom the buccaneers waged war, and partly because, as it seems, the English had the good sense—perhaps the humanity—to treat them well. Had the natives been hostile travelling by land would have been made more difficult than it was, if not quite impracticable.

Wafer seems to have been much impressed by the presence of albinos among the Indians; their numbers he estimated at one to every two or three hundred of the population. He seems to have been quite ignorant of the existence of albinism in Europe, and of course does not use this term, but he quite accurately describes it, including the visual troubles which are incident to it, and he realized that the albinos were not a separate race. Much as he liked the Indians, he did not extend his affection to their arboreal cousins, the monkeys of the isthmus, who, he says, are—

> "a very waggish kind of Monkey, and played a thousand antick Tricks as we march'd at any time through the Woods, skipping from Bough to Bough, with the young ones hanging at the old ones Back, making Faces at us, chattering, and if they had opportunity, pissing down purposely on our Heads."

The buccaneers found the monkeys very good eating and taught the Indians to overcome their repugnance to this kind of meat.

One of Wafer's party was a Mr. Richard Gopson, who had served an apprenticeship to a druggist in London. This bold buccaneer carried with him a copy of the Greek Testament; he occupied his leisure in its study, and would read aloud in English to anyone who cared to listen. Gopson is an instance of the heterogeneous composition of a privateer's crew, to which Dampier alludes when he says that one ship's company comprised skilled artisans in every craft, so that they were capable of all sorts of constructive work as well as of the wanton destruction with which the buccaneers are generally credited.

No doubt many of them were not criminally inclined, but took to the life from sheer love of adventure, tinctured with the hope of gain. Their life was hard at sea, and no less hard when travelling on the isthmus carrying all their belongings on their backs. Crossing a river in flood, loaded with a heavy musket, ammunition, and three or four hundred pieces of eight (or dollars), was no child's play, and at least one of them owed his death to his load of silver, which must alone have weighed more than twenty pounds.

His dressings and drugs being lost, Wafer submitted to an

Indian method of cure, which consisted in the application of poultices of chewed herbs of unknown origin; in this way he was cured in twenty days, except for a persistent weakness and numbness. Native surgical methods seem to have been less simple, for Wafer gives the following account of the way in which a patient was bled:

"The Patient is seated on a Stone in the River, and one with a small Bow shoots little Arrows into the naked Body of the Patient, up and down; shooting them as fast as he can and not missing any part. But the Arrows are gaged, so that they penetrate no further than we generally thrust our Lancets: And if by chance they hit a vein which is full of Wind, and the Blood spurts out a little, they will leap and skip about, showing many Antick Gestures, by way of rejoicing and triumph."

A similar method has survived in New Guinea up to the present time for opening abscesses. Specimens of the bows and arrows employed are to be seen in the Wellcome Historical Museum, 54A, Wigmore Street, London.

There is a quaint illustration in the original book showing this operation. It having been decided that one of the wives of Lacenta, the Indian king, should be blooded in this manner, Wafer persuaded the king to allow him to bleed from a vein in the usual way. Alarmed by the sudden gush of blood, the Indian at first threatened to take the operator's life, but when the arm was bound up and the patient happily recovered he was delighted with his new Court surgeon. Just as Dr. Gabriel Boughton is said to have gained the confidence of the Emperor of Delhi and his viceroy by his successful treatment of their womankind, so on a much smaller scene did Wafer gain the confidence of the King of the Darien Indians, to the no small advantage of himself and his companions. So successful was he that the king could not for a long time be persuaded to part with him, but kept him about his person, offered him his daughter in marriage (as soon as she should be old enough), and took him with him on all his expeditions. Wafer "lived in great Splendour and Repute," and adopted the Indian full-dress of a coat of paint, a gold nose-plate clipped on to the septum nasi and hanging down over the upper lip, and a funnel or horn concealing the penis, but leaving the scrotum exposed. The painting was done by the women, usually by tattooing; to this Wafer would not submit, but he had the colours laid on in little specks, "red, yellow, and blue, very bright and lovely."

Lacenta was at length persuaded to part with the Englishmen on a plausible pretext and sent them to the north coast, where they found Dampier and his friends with a vessel, which they had acquired in the usual way. (Convey, the wise it call!) The journey across swollen torrents and a lofty mountain range was difficult, and in traversing the mountains the Europeans seem to have suffered from the rarity of the air.

Wafer had been some hours on board ship in his coat of paint and his nose-piece before he was recognized with the joyful shout of "Why, it's our doctor!" He says that a month elapsed before all the paint had worn off.

For six years more he was with the buccaneers: in Virginia, on the Guinea coast, and round Cape Horn to the Philippines, and then back to London. Besides the account of his life among the Indians his book includes descriptions of the country and its products, and of his adventures in the South Sea, but these are of little interest compared with those of Dampier, and it is to be remembered that, as he says, he kept no journal, whereas Dampier made notes of his observations at the time. No doubt Wafer was induced to publish his book by the interest excited at home by Paterson's disastrous attempt to colonize Darien. The main facts of his story are corroborated by Dampier, and there seems no reason to doubt his substantial accuracy.

With the advent of peace between France and Spain and a better understanding between Great Britain and that country, the buccaneers' occupation soon became too hazardous. The more desperate characters among them became pirates of the indiscriminating and uncompromising type with which writers of fiction have made us familiar, many of whom ended their careers at Execution Dock, instead of, like Wafer and R. L. Stevenson's Industrious Pirate, "retiring and being respected by his neighbours."

As for Dampier, he became a recognized authority on geography, oceanography, and meteorology, and as such was consulted by the Government, and was given the command of a king's ship with which to explore New Guinea and Australia, where he gave his name to Dampier's Straits, but accomplished little else of note.

England and Wales.

London's Water Supply.

Sir Alexander Houston's report to the Metropolitan Water Board for the year ending March 31st, 1922, shows that by that time the acute anxieties caused by the great drought of 1921 had been much allayed by the rains of the early months of this year. In a note on the subject in our issue of June 24th we ventured to hint that a change of weather might come in time to replenish London's sources of supply, and this is what happened. But the peril escaped is not being forgotten, and the problem of how to provide against future dangers is occupying the mind of the authorities. It is now some thirty years since Lord Balfour of Burleigh's Committee considered the great scheme for settling once for all London's difficulties by impounding a practically inexhaustible supply from the mountains of Wales, and leading it across England to the metropolitan area. The cost would have been enormous, and in spite of the weighty considerations urged in its favour the scheme was rejected. Fate has been kind to the tribunal which reached that momentous decision. Enteric fever, which was then almost endemic in this country, has very greatly diminished, and London's present water supply cannot be charged with having been the means of conveying that or any other of the water-borne diseases to the inhabitants. The double principle of prevention of pollution at the sources of supply, and purification after caption, has been wonderfully successful. Yet the possibility of a breakdown cannot be ignored, and Sir Alexander Houston urges now, as in former reports, the risks of an accident and the need for ceaseless watchfulness.

"If the true history of all past water epidemics could be learnt," he says, "in nearly all cases something in the nature of an accidental circumstance would be found to be the explanation. Further, in many cases, it is to be feared it would be true that the accident was not wholly divorced from lack of forethought or breach of common-sense precautions, even if the charge of culpable negligence were not admissible."

That mental attitude should always be maintained. Continuous alertness towards even the remotest chance of disaster is the best safeguard against its occurrence.

The other constant problem is the maintenance of an adequate supply. The term "adequate" cries out for definition. Is it to be measured by the standards of great cities so fortunately situated as to have water abundantly available, so that they have at command such quantities as to make waste of no account and economy a profitless virtue? Or is it to be measured by the actual necessities for health and cleanliness and comfort, including such services as the watering of gardens and the washing of motor cars, as well as for manufacturing and trade purposes? All this, of course, subject to regular inspection, and to persistent education of the public in the individual duty of avoiding the running to waste of what is an absolute necessity for the welfare of the community at large. If the former, then the London water supply is hopelessly inadequate; if the latter, a fair case can be stated for its minimal sufficiency. From present sources there is no possibility of obtaining the fifty or sixty gallons a head a day of which some great populations can boast; but London may be able to work away, at least until better times come. Sir Alexander Houston indicates that the Ministry of Health would regard the low figure of sixteen gallons a head a day as not inadequate for domestic purposes, and in London manufacturing requirements are not nearly so great as in the industrial areas. At the best the position cannot be regarded with entire equanimity, but it may be taken for granted that the experience of last year will result in the whole position of the supply being reviewed and every effort made to provide against the risks which attach to the vagaries of the rainfall. Last year it was only about 17 inches, a figure which has no parallel in the sixteen years for which the records are tabulated in Sir Alexander Houston's report.

The report deals in the usual careful and detailed fashion with all the activities of the water department. Chlorination continues to be a main factor in the protection of the consumer against pollution. Three main objections to it are a sentimental dislike of "doped" water, an occasional unpleasant taste, and the fact that its use may be regarded as a short cut to purity. But the author of the report holds that chlorination has a great future—that it saves pumping, supplements other measures which are apt to fail under adverse weather conditions, can probably make almost any

water epidemiologically safe, has led in a number of instances to the reuse of abandoned sources of supply, can be resorted to as a temporary measure in emergencies, can be applied for protection of water in difficulties which arise in the cleansing of low-lying filter beds, and, when combined with rapid filtration, gives a safer result than slow filtration without chlorination. The methods—gaseous, liquid, and solid—of administering chlorine to water are stated as constituting a brief reply to many queries which the author of the report has received.

The diminished prevalence of enteric fever has already been referred to, but the statistics which Dr. Hamer, medical officer of the London County Council, has furnished to Sir Alexander Houston are so striking that some of them may be noted here, though the area to which they refer is not conterminous with "Water London." In 1900 the cases numbered 4,292, and the rate per 100,000 living was 95. By 1903 the cases had fallen to 2,339, and the rate to 51. During the next eight years, 1904 to 1911 inclusive, the cases gradually diminished from 1,896 to 1,022, and the rate from 41 to 23. Then the cases fell below 1,000 per annum, and have steadily gone down from 704 in 1912 to 329 in 1921, the corresponding rates being 16 and 7 per 100,000 inhabitants. It is not alleged that all this is due to the work of the Metropolitan Water Board, for a great reduction in enteric fever has taken place throughout the whole country. The point is made to indicate how much less risk there now is of contamination of a water supply by that infection than there was at the beginning of the century.

Lying-in Homes.

A by-law has been added by the London County Council under its General Powers Act, 1921, to the regulations governing lying-in homes. The new by-law, which does not take effect until it has been confirmed by the Minister of Health, prescribes the records which are to be kept with regard to the persons received and the business carried on at a lying-in home, and requires the notification to the Council of any death occurring at such a home. The keeper of a lying-in home will be required in future to keep a register of patients received and to state the date and hour of the delivery of the patient, the name of the doctor or other person in attendance, and the date of the patient's discharge. The register must also contain particulars of the death of a patient or of any infectious disease from which she was suffering while in the home.

Attendance on Firemen and Drain Workers in London.

The London County Council provides free medical attendance for its firemen and the men employed on the main drainage (altogether about 2,170 persons). The county is divided into twenty-five districts, and a medical officer is appointed for each. Before the war the district medical officers were paid at the rate of 10s. a year for each man entitled to medical attendance. This rate has been increased since December, 1918, to 11s. 6d. a year. The fee includes the provision of all requisite medicines and simple surgical appliances, as well as ordinary certification. It is reckoned that the Council's fees approximate to the capitation fee for insured persons (9s. 6d., exclusive of medicines and dressings), while they are considerably less than the fees paid by the Metropolitan Water Board (15s. a year for each person). It was resolved at the last meeting of the Council to continue the present fees until December 31st, 1923, when they will be reconsidered.

Scotland.

Sir James Hodsdon and Edinburgh Royal Infirmary.

At a meeting of the Board of Management of Edinburgh Royal Infirmary on August 7th a minute was adopted in regard to the retirement of Sir James W. B. Hodsdon, senior surgeon of the infirmary, from its active staff. The Board placed on record its deep appreciation of the great services which he had rendered to the institution, not only by his dexterity as a surgeon, but by the sagacity and sound judgement with which he had exercised his skill, by his broad sympathy with the suffering, and his courtesy to his fellow workers. He was invited to become an honorary consulting surgeon to the infirmary.

The Vital Statistics of Scotland for 1920.

The Scottish Registrar-General's Report for 1920, referred to in our issue of July 29th (p. 176), has now been issued. Its completion was delayed until the results of the 1921 census of Scotland were available for use in the compilation of statistics. The year was one of maxima and minima. The births and marriages were the highest ever recorded; the death rate and the infantile mortality rate were the lowest. This must surely be a unique as well as a most satisfactory grouping of statistical facts relating to one and the same period of time. But the Registrar-General evidently regards it as outside his province to indulge in any kind of jubilation; he ploughs steadily on, looking neither to the right hand nor the left, through what a bad punster would call his figurative volume. We, however, take the liberty of congratulating all concerned, especially the Registrar-General and the Scottish Board of Health, on their *annus mirabilis* of 1920, and in a later issue we shall endeavour to garner some of the fruits of their labours. It is told of a famous health officer in the northern kingdom that on one occasion, meditatively marching along with his sanitary inspector to visit the scene of a nuisance, he suddenly broke the silence as follows: "Macpherson, have you noticed that the death rate in our town has been remarkably low this last month?" "Yes, Sir, I have noticed that." Then another half-minute of silence, ending again with: "Macpherson." "Yes, Sir." "Nae thanks to either you or me." It is the utter and obvious irrelevance of this story to the present occasion that gives us the safe opportunity of telling it.

The Census of the Four Great Towns of Scotland.

A preliminary report on the Scottish census of 1921 was published before the end of that year. Additional reports are now in course of issue, and include those of the four great towns of Scotland—Glasgow, Edinburgh, Dundee, and Aberdeen. It is a very notable fact that, apart from extension of boundaries, three of the four show a decrease in population, the only increase being in Glasgow. Unfortunately, however, the data are vitiated by the date on which the census was taken. Until 1921, April was the census month, but in that year a labour strike made it necessary to defer the numbering of the people until June 19th, when many folk are already on holiday at the coast or in the country, though of course the rush does not occur until later—July and August in Glasgow, and August and September in Edinburgh.

Glasgow.

The population in 1911 was 784,496, but in 1912 extension of boundaries added areas of which the population at the census of 1911 was 223,991, making a total of 1,008,487 at that time. In 1921 the total was 1,034,174, being an increase of 25,687. This is a growth of only 2.5 per cent., but it is estimated that a census at the proper time would have shown at least 30,000 more. In 1801 the population of Glasgow proper was only 46,779, but the suburbs of Barony and Gorbals, long since included, made with the city a total of 77,385. At that time Edinburgh's population was 67,288, so that the two cities were much on a par. Now, even with Leith added, Edinburgh is not much more than two-fifths the size of Glasgow. Including extensions Glasgow is about fourteen times as large as in 1801. Its extended area is 18,589 acres, so that the population per acre is 55.63 persons. But such statements of density are of comparatively little value, because the centre may have a density many times that of the outskirts, and an extension of boundaries makes only a statistical change in that respect. The slums are as before, and the outer fresh air is brought no nearer to them than when the annexed areas were regarded as being within the territory of neighbouring authorities. Glasgow includes the whole or part of no less than eight parishes, varying in population from 587,030 downwards. It rejoices in fifteen members of Parliament, in whose divisions the populations range from 48,376 to 92,856. For every 100 males in Glasgow there are 105 females, whilst in Edinburgh the ratio of females is 119, in Dundee 125.4, and in Aberdeen 118.6, per 100 males.

The effect of the war is seen in the age constitution of the population. Males from 40 upwards have increased, but from 20 to 40 they are fewer. The mean age of the population, including both sexes, was 28.7, against 27.1 in 1911. In females the mean age was slightly higher than in males. In Edinburgh the mean age was 31.2, in Dundee 30.5, and in Aberdeen 29.8. As to conjugal condition, at ages from 15 upwards, the unmarried women were only 2.4 per cent. more numerous than the unmarried men, whilst in Edinburgh the excess percentage of unmarried women was 35.

Housing.—In Glasgow 12.8 per cent. of the population are living in houses of one room, 49.8 per cent. in two-roomed

houses, 20 per cent. in three-roomed, 6.1 per cent. in four-roomed, 2.9 per cent. in five-roomed, and 1.6 per cent. in six-roomed.

The chief *occupations* are: Workers in metals, 101,540; in transport and communication, 54,598; in commercial occupations (excluding clerks), 53,954; clerks (not Civil Service nor local authority), 39,360; personal service, 35,969; textiles, 26,590; wood and furniture, 23,271; professions, 17,850, including 666 medical practitioners.

Edinburgh.

The census population was 420,264, against 320,318 in 1911. The addition of close on 100,000 is more than accounted for by extension of boundaries, the added areas having had a population of 103,728 in 1911, so that there is a real decrease of 3,782 in the extended city. The added area itself, however, made an increase from 103,728 to 108,426, so the diminution in Edinburgh's former area was all the greater. The Edinburgh of to-day has six times the population it included in 1801, and double what it had in 1881. The area of extended Edinburgh is 21,524 acres, or very nearly the double of what it was before the extension, and is nearly 3,000 acres more than that of extended Glasgow, so that its nominal density is only 12.97 persons per acre, but that aspect of the matter has already been mentioned in relation to Glasgow. There are in Edinburgh 36,238 more females than males, the ratio as already noted being 118.9 to 100. Of the female population over 15 years of age 45.41 per cent. were unmarried, 42.04 married, 12.40 widowed, and 0.15 divorced.

In one-roomed houses 4.7 per cent. of the population live, in two-roomed 32.9, in three-roomed 22.5, in four-roomed 13.9, in five-roomed 6.0, and in six-roomed 3.7 per cent. These figures are much better than Glasgow's. Amongst occupations the professions bulk largely in Edinburgh, the total being 15,199, male and female. They include 4,461 teachers, 2,048 sick nurses, 972 lawyers, 612 doctors, 579 ministers, clergy, monks, and nuns, 167 dentists, and 3,680 professional students.

Dundee.

The census population was 168,315, being a nominal increase of 3,311 over 1911, but in the interval extensions of boundaries took place, bringing in a population of 11,347, so that in the extended area there has been a diminution of 8,036, or 4.6 per cent. In 1801 the population was 26,084, or about one sixth of what it is now. The extended area of the city is 6,555 acres, and the nominal density 25.68 per acre. The excess of females over males is 18,957, the ratio being 125.4 females to 100 males. Over 15 years of age the excess of females is 36.9 per cent. In one-roomed houses there live 8.9 per cent. of the population, in two-roomed 50.8 per cent., in three-roomed 20.9, in four-roomed 7.0, in five-roomed 3.1, and in six-roomed 2.1. The chief occupations are textiles (flax, hemp, and jute workers) 35.8, per cent. of the total, metal workers 10 per cent., commercial occupations (not clerks) 8.7, transport and communication 7.2, and personal services 5.9. Of the textile workers three-fourths are females, and the total number of persons in this employment is 36,669.

Aberdeen.

The population numbered 153,963, being a decrease of 4,928, or 3.0 per cent. In 1801 the population was 26,992, and this is the first census which breaks the continuous growth since then. There is an excess of females over males of 13,523, or 118.6 to 100. The average age of the entire population is 29.8 as against 27.6 in 1911. In one-roomed houses there live 4.4 per cent. of the population, in two-roomed 32.6 per cent., in three-roomed 31.5, in four-roomed 12.5, in five-roomed 3.5, and in six-roomed 3.7. The figures are better than those of 1911. The principal occupations, stated as a percentage of the total occupied persons, are: transport and communication, 12.8; commercial occupations (excluding clerks), 11.6; personal service, 9.3; metals, 8.4; clerks (not Civil Service nor local authority), 6.6; professional occupations, 5.8; wood and furniture, 5.5; and textiles, 5 per cent. Workers in stone are 4.3 per cent., and fishermen 2.8 per cent. Of the transport workers 1,264 are connected with railways, 2,826 with roads, and 2,956 with water transport.

Housing.

The following table shows for each of the four cities the percentages of population living in houses of from one to six rooms stated separately.

No. of Rooms:	One.	Two.	Three.	Four.	Five.	Six.
Glasgow	12.8	49.8	20.0	6.1	2.9	1.6
Edinburgh	4.7	32.9	22.5	13.9	6.0	3.7
Dundee	8.9	50.8	20.9	7.0	3.1	2.1
Aberdeen	4.4	32.6	31.5	12.5	3.5	3.7

In this respect it will be observed that Glasgow and Dundee are in decidedly a worse position than Edinburgh and Aberdeen, but according to English standards none are good. Speaking broadly, the same system of housing exists in all the four cities—great buildings (curiously called "lands") three or four stories high, each with multiple dwellings on every floor, opening off a common stairway. Much improvement in detail is to be found in the more modern houses, but the system in its essentials remains. It goes far back into the past. Curiously, the terms "house" and "tenement" are in common speech used in opposite senses in Scotland and England. In England the actual dwelling is the tenement, whilst (if it does not stand apart as a cottage) the building of which it is a part is the house. But in Scotland the dwelling is the house, and the great building on one of whose floors it is situated is the tenement, or "land." If one of these blocks is for sale it may be described as "a land of houses," though the description is falling out of use.

Ireland.

IRISH ARMY MEDICAL COUNCIL.

DR. M. R. J. HAYES, F.R.C.S.I., Lieut.-Colonel B. Forde (retired, R.A.M.C.), and Dr. P. J. Smyth, Fitzwilliam Street, Dublin, have been appointed whole-time officers of the new Irish Army Medical Council. The main duties of the Council will be to formulate a scheme for the organization of a medical corps for the Irish Free State Army.

APPOINTMENT OF A MEDICAL OFFICER.

The co. Cavan Health Committee, when a vacancy occurred recently in the Dowra Dispensary District, advertised the post at a salary reduced by almost 50 per cent. Several abortive attempts were made to fill the post. The Irish Medical Secretary made representations to some intending candidates—mainly women doctors—who withdrew their applications when the position of affairs was explained to them. The Health Committee, however, in spite of the efforts of the medical organizations, succeeded in filling the appointment, and elected Miss O'Reilly, L.R.C.S.I., Dublin. The facts of the case were put before Miss O'Reilly, and she was informed of the withdrawal of the other candidates.

COUNTY WEXFORD MEDICAL PRACTITIONERS.

The following resolutions were passed unanimously at a recent meeting of medical practitioners held at Enniscorthy:

1. That we are of opinion the notification of tuberculosis by the medical attendant should be with the consent of the patient unless the position of the patient is such as to be a danger to the community.
2. That the fees proposed to be paid to the profession for the notification of tuberculosis are altogether unacceptable for professional work, and inadequate when the importance of the duties is considered.
3. That in the circumstances we are of opinion that the profession in Ireland should await the directions of the Irish Medical Committee with regard to the scheme proposed by the Local Government Department for the notification of tuberculosis.
4. That we avail ourselves of this meeting to state that we have learned with much disappointment the decision of the Local Government Department to disqualify medical officials of the County Health Board from acting as representatives of the local profession on these boards. That we consider this decision as reactionary, and contrary to the precedent of medical representation, without any official disability, as provided under the Insurance Acts in the case of County Insurance Committees, and also contrary to the recommendation of the Irish Public Health Council that officials should be eligible to act as representatives of the profession on the local health bodies.

When the resolutions came before a meeting of the co. Wexford Health Board it was decided to send the resolution of the medical practitioners dealing with the notification of tuberculosis to the Dail for its observations.

THE New York City Health Department, on June 26th, opened a riverside convalescent camp on North Brother Island for patients suffering from whooping-cough, a disease with which about 500 children in the city were reported to be affected. Few of the hospitals have facilities for treating them during convalescence, but in the new camp there is accommodation for 2,000 children, who will be kept there for six weeks or longer without expense to their parents.

Correspondence.

STERILIZATION OF MENTAL DEFECTIVES.

SIR,—Dr. J. R. Whitwell writes (BRITISH MEDICAL JOURNAL, July 8th, p. 64): "The person who advocates sterilization assumes, first, that we know exactly how heredity acts, and secondly that by sterilization we should only prevent the production of the unfit." Doubtless none of us "know exactly how heredity acts," but surely all medical men know sufficient for the purpose. May I set down a few commonplaces of knowledge?

The individual is derived from a germ cell. Therefore he can inherit only through it. In the germ are none of the characters (for example, head, scar knowledge of Latin) which he subsequently develops, but only powers (potentialities, capacities) for developing them. Therefore he inherits not characters, but only potentialities. Characters arise in response to nurture—for example, food, moisture, light, heat, use, injury, internal secretions. The sum up of the individual's powers for development is his *nature*. The sum up of the influences which play on him and cause development or change is his *nurture*. The nature of the individual is rigidly fixed and limited and, therefore, he can develop only within the limits imposed by it. Thus the germ of a man can develop only into a man. But his nurture may vary within wide limits, and, therefore, he need not, and commonly does not, develop all that his nature permits. For example, he must develop a head, for without it he could not exist, but lacking the right injury, or teaching, he may not reproduce a particular scar or item of knowledge. Obviously, then, inheritance is one thing, and reproduction quite another thing. There may be inheritance without reproduction, but there cannot be reproduction without inheritance. Thus a germ which has inherited everything may perish before it has developed anything.

Offspring invariably differ from their parents somewhat. These differences are natural or nurtural, or a combination of both. Thus a man may be darker than his parent by nature, or by nurture, or by both. Technically, natural differences are termed "variations" and nurtural differences "modifications." It is agreed on all hands that variations are transmissible. The statement that modifications are transmissible is neither true nor untrue. It is merely nonsensical (see *Nature*, November, 1920, to May, 1922). It involves a play on words. The germs of some living beings (for example, plants, insects, fish, and reptiles) are cast naked into the world, exposed to all its vicissitudes; the germs of other types (for example, mammals) are sheltered within the body of the parent till development is far advanced, yet individuals developed from the former display, as far as is known, no greater range of variations than those developed from the latter. Thus, in a litter of puppies may be found as great a range of variations as in fish hatched from naked ova. The fact that some species that void naked ova have existed almost unchanged from geological time indicates how obstinate is the resistance of germs to enforced change of nature. Of course, every germ is liable to injury or other enforced change; but, like other living beings, it tends, if it survive, to recover and return to the normal. If it does not recover it tends to perish and leave no descendants. It follows that nearly all variations are "spontaneous"—that is, not caused by the action of nurture. They are experiments made by blind nature, groping towards improvement.

We are now in a position to formulate a law, which I think no one will dispute, and which covers the whole range of heredity. "Offspring vary spontaneously from parents; variation is the sole cause of non inheritance; apart from variations, like exactly begets like if parent and child develop under like conditions."

But this law does not cover reproduction. For example, if white and negro mate, the offspring is mulatto. Mulattos, interbred, have mulatto offspring. With every infusion of white the touch of the tar brush grows fainter. There is blending in nearly all particulars. The most conspicuous exceptions are in sex and in eye colour. The child is a boy or a girl—hardly ever, if ever, hermaphrodite; and the eyes are black. But there is massive evidence derived from many species of animals that male is undeveloped female, and vice versa. Some sort of nurture, occurring early in life, turns the scale and makes the individual male or female. In aphides heat is the factor; for during summer only females are present which produce parthenogenetically; but, with autumn chill, males appear. In hothouses only females occur for any number of years. It follows that the females inherit, but do not reproduce, the male characters. There is not alternate inheritance, but alternate reproduction—alternate patency and latency. As regards eye colour, when white and negro mate, black is prepotent; but the prepotency is weakened with each infusion of white; so that at length blue eyes suddenly appear. If there were alternate inheritance, not merely reproduction, the prepotency could not be weakened, and black eyes would occur in all descendants.

Of course, the patent sexual characters of the male do not tend to blend with the patent characters of the female. They belong to different sets. The patent characters of the male blend with the latent male characters of the female; and vice versa. There is, thus, universal blending. Now there is massive evidence that, when mating individuals differ sharply in a particular other than sex, the reproduction in that particular often follows the sexual pattern. Sometimes the latency of such a character is prolonged. Man, as Darwin noted, has often seized on such sharp differences to create his cultivated plants and domesticated animals and, therefore, in them long latent ancestral traits tend to appear. Thus plants reproduced from seed often revert to the wild type. Pure-bred poultry and pigeons sometimes reproduce the ancestral coloration of *Gallus bankiva* and *Columba livia*, and if a horse be crossed with the broad-striped Burchell zebra the narrow stripes of the enormously remote Somali zebra are seen. Crossing is one of the conditions which cause latent ancestral traits to reappear. Hence the frequent reappearance of them when fancy varieties of plants and animals, which are largely founded on abnormalities, are crossed. They never appear when wild types are crossed. It would seem that the horse has descended from the Somali zebra.

As all medical men know, the reproduction, not inheritance, of many human abnormalities (for example, club-feet, hare-lip, idiocy) is alternate. The abnormality may be latent for many generations, but at last conditions, probably analogous to those which govern eye colour, may occur which render it patent. Idiocy and its lesser degrees, imbecility, feeble-mindedness, and natural stupidity are particularly interesting. Man is the educable animal. The normal man can learn and has learned. The newly born normal infant can learn, but has not learned. The idiot cannot learn, and has not learned. There in a nutshell is the difference between the extremest of human mental types. The perfect idiot cannot learn even to walk or speak. He differs from the normal man merely in this matter of learning; but the difference is enormous. He has lost *the* distinctively human character. Great abnormalities, occurring spontaneously, are rare. But idiocy is common, and becomes more so every year. It is impossible to account for its frequency except under the supposition—confirmed by the high proportion of idiots in tainted families—that idiocy is rarely a spontaneous variation, but is commonly the patency of an often latent trait. It does not matter in the least that bishops and ambassadors occur in families tainted with idiocy. Idiocy may be latent even in these exalted personages. Moreover, dignity of that sort does not usually imply genius, but, as a rule, only a golden spoon.

I do not know if Dr. Whitwell can find any error of fact or reasoning in the above. I have dealt only with matters within common experience. If I am correct, a single idiot may taint a whole race, and in that case doubtless we in England are extensively tainted. But it is possible by careful breeding to render an abnormality almost permanently latent—as in the case of the wild coloration of poultry and pigeons. I can imagine no way of effecting this in the case of mental defect except through sterilization.—I am, etc.,

Southsea, Aug. 15th. G. ARCHDALL REID.

THE PREVENTION OF CEREBRAL HAEMORRHAGE.

SIR,—The death from cerebral haemorrhage of a public man aged 50 at a time of political crisis suggests the inquiry whether we are doing all that is possible to avert or at least postpone such disasters. It seems that brain workers everywhere, including prominent figures in the medical profession, are becoming more subject to these melancholy accidents, at the height of their powers and influence. Every year we see not a few men of the greatest experience and distinction lost thus prematurely to the country. Is it always inevitable? I think not.

There are not always obvious signs that a man is "on the verge of a stroke." He may indeed seem and feel exceptionally well, although not usually. It has fallen to me to

examine a large number of middle aged men. They were not ill, but they came, as all men in middle life ought to do periodically, to be "overhauled." Many observers besides myself have no doubt been warned in such cases by a spasmodic and irritable condition of the arteries. The state of contraction sometimes called "hypertonus" is clearly at first entirely spasmodic, for it may be readily relaxed under treatment (for example, venesection), or on the other hand increased by nervous and other disturbances. The arterial blood pressure naturally follows every wave of vascular contraction and relaxation. If the tension continues to mount there must come a time when, following perhaps on some mental or physical exertion or even a change of posture, an unsupported blood vessel gives way somewhere, if not happily on one of the mucous membranes then perhaps in the more delicate tissues of the brain.

In a paper read this year at a congress of physicians at Washington I suggested the systematic use of *blood-pressure charts*. Upon these charts the readings of systolic and diastolic pressures should be entered from year to year, or more often, and the resulting curve plotted out, so as to ascertain in cases under periodical observation whether the vascular mechanism showed signs of strain beyond the limits of safety. I pointed out that in many cases followed for a series of years a venesection at the right moment had produced an arterial relaxation out of all proportion to the amount of blood removed, and that the early symptoms of vascular breakdown had been entirely and promptly removed. The observations on which these conclusions are founded may, I hope, be published later. My object in this letter is to encourage the resort to venesection in cases of high tension as a preventive of cerebral haemorrhage. Some patients so affected ought to be bled once or twice in every year. For others a fairly free venesection at longer intervals seems sufficient. To find any ill effects from such a practice one must go back to the absurd excesses of former times. Its good effects are sometimes almost startling both to the patient and the medical man.—I am, etc.,

London, W., Aug. 15th. R. FORTESCUE FOX.

THE TEACHING OF PSYCHOTHERAPY.

SIR,—Dr. McBride's letter in your issue of August 12th (p. 282) is most interesting, since he proves the very point he questions—the existence of the unconscious.

The reduction of dreams to the sexual is unacceptable to him, and he therefore seeks to prove that Freud contradicts himself by unconsciously quoting a sentence without its context. If he will reread the whole of the paragraph on page 454 of Freud's *Interpretation of Dreams* he will find that Freud is referring to a dream becoming a perception as the result of the sensory stimulus having directed part of the energy of the foreconscious in the form of attention on the stimulant. It is to this that Freud refers when he says on page 197: "The dream is the guardian of sleep, not the disturber of it. We shall justify the conception with respect to the psychic factor of awakening elsewhere. . . ." Dr. McBride makes the mistake of regarding the mind as an anatomical entity, whereas it is the psychic link between perception and action.

The sexual theory of dreams is not by any means accepted universally. Even Freud says, "the *majority* of dreams of adults treat of sexual material and give expression to erotic wishes." Jung, one of Freud's foremost pupils, disagrees with the whole-hearted sexual theory and standardization of symbols. On the other hand, nobody denies that some dreams are of sexual origin and in any case a whole dream or part of it may be overdetermined.

No analyst suggests a sexual or any other interpretation to his patient—the interpretation must be that of the dreamer or the value of free association would be lost. The analyst's part consists almost entirely in keeping his patient from wandering too far from the subject and urging him on when resistances present themselves. It is in the latter connexion that auto-analysis usually fails, which is to be expected from the nature of conflicts.—I am, etc.,

Cannock Chase, Aug. 12th. JAMES W. W. ADAMSON.

SIR,—Dr. McBride accuses Professor Freud of making contradictory statements. The latter is stated to have said on page 454 of his *Interpretation of Dreams*: "We must, therefore, admit that the dream invariably awakens us," and again, in the *Introduction to Psycho-analysis*: "We do not wake up out of all dreams."

May I suggest that it is not fair to any writer to drag such remarks from their contexts? The former quotation occurs in the exposition of a wonderful attempt to formulate a theory of the mind which calls aloud for consideration as a whole. The meaning implied is that the perception in consciousness of the dream is equivalent to the awakening of the foreconscious; it does not necessarily involve the termination of sleep. One of Freud's definite view-points is that dreams are the protectors of sleep.

Again, with regard to symbolism, symbols are not "the elaborate code of the psycho-analysts"; they are the conscious and unconscious property of us all. I believe a recognition of the unconscious is admitted by psychologists of most schools of thought.

Is it permissible to add that Freud cannot be understood from "desultory reading" by "one who is neither a neurologist nor a psycho-analyst"?—I am, etc.,

W. S. WILLMORE,
Bournemouth, Aug. 13th. Lieutenant-Colonel I.M.S.

ARSENIC IN ULCERATIVE ENDOCARDITIS.

SIR,—Having retired from practice since April, 1918, after many years of active work, I feel some diffidence whether to write this letter upon the subject of ulcerative or malignant endocarditis, in the hope that the great fatality attending this affection may be minimized. I can only recall some three or four cases in my practice, and therefore conclude that, fortunately, the disease is not common; nevertheless, considering the great mortality, it was my intention to try the influence of arsenic as a sort of forlorn hope in overcoming the causes of this mortality, which undoubtedly to a great extent is due to the septic poisoning resulting from an open raw surface in a vital channel containing the necessary purifying blood for the life of the body. The question naturally arises, How is this poisonous secretion to be purified and the healing of an open wound thus promoted? Most of our antiseptic remedies cannot be tried in sufficient strength to be of any use. Arsenic, however, from its great power, judiciously administered, is worthy, in my opinion, of a trial, though we will be sailing between Scylla and Charybdis. The preparation used should be the sodium salt, which is preferable to any other; the earlier this fatal affection is treated thus the better the prospect of success, and it should be given in a liquid form and in as large doses as the patient can safely tolerate; as soon as evident improvement is manifested the dose should be gradually diminished, never giving more than what may be absolutely necessary.

This is an open letter to the profession for due consideration as a possible means of mitigating the influence which a foul wound would have upon the system. Hitherto I have not seen any statement of this remedy having been tried, hence the reason of my suggesting a trial being made by the profession.—I am, etc.,

Leamington Spa, Aug. 15th. JOHN LYCETT, M.D.

THE GROWING ABUSE OF COCAINE.

SIR,—An article in the BRITISH MEDICAL JOURNAL of August 19th draws attention to a subject of importance to those of us who have occasion to prescribe cocaine for legitimate purposes. The present law hedges its prescription by irritating documentary formalities. Cannot the abuse be attacked at its source?

For many years substitutes for cocaine—such as alypin, stovaine, eucaine, novocain, and others—have been suggested. Each has claims, each objections, and none approaches cocaine in general efficiency.

In a recent number of the *British Journal of Ophthalmology*[1] I called attention to a new synthetic preparation, butyn, which, as far as ophthalmic surgery is concerned, seems to me, after six months' experience of it, to be a perfect substitute for cocaine. During that period I have had no occasion to go beyond it in any case requiring local anaesthesia. In the United States a committee of well-known ophthalmic surgeons appointed by the American Medical Association has reported on butyn in a most enthusiastic way, pointing out that for practically all purposes it is superior to cocaine.

Is not the time also ripe in this country for an authoritative investigation of its claims? I would suggest that a committee appointed by the British Medical Association or by

[1] Vol. vi, p. 316.

the Royal Society of Medicine should consider the whole question of local anaesthesia, with especial reference to substitutes for cocaine.—I am, etc.,

Bath, Aug. 20th. W. M. BEAUMONT.

WOOD-HILL FUND.

SIR,—This fund being now closed with the publication of the tenth and last list of subscriptions, it would seem desirable to make some comments on the importance to the profession of the verdict given in this case, and to give some details about the fund itself.

An action was brought against Dr. Wood-Hill of Beccles for alleged negligence in the treatment of a lady who was suffering from a fractured femur, the result of an accident. The case was reported in your issue of November 26th, 1921. Notwithstanding that evidence was brought forward to show that Dr. Wood Hill treated the case by approved modern methods, and that when the lady left his neighbourhood to go to her own home he urged her to consult her own doctor, and to be guided by his advice before she put any weight on the limb, the jury returned a verdict for the plaintiff with damages to the amount of £750.

The verdict at once excited widespread sympathy with Dr. Wood-Hill, as it was felt that a serious miscarriage of justice had taken place. Unfortunately, Dr. Wood-Hill had neglected to join one of the medical defence societies, and for this lack of foresight no excuse can be offered. The costs of the action with the damages awarded came to the large sum of £2,250. The fund to assist him in this serious emergency was started by a letter of appeal signed by us in your issue of December 3rd, 1921.

The verdict is of great importance to the medical profession. It proves that although a medical man may have exercised all the skill at his disposal, and adopted approved modern methods in the treatment of a case, yet he still has to run the risk of an adverse verdict if the case does not finally do well. We feel this to be an unjust widening of a medical man's responsibility in the practice of his profession. Prior to the case of Clayden *v.* Wood-Hill a medical practitioner might feel fairly confident that if in the treatment of a case he used the ordinary care and skill which could rightly be expected of him he ran small risk of an adverse verdict in an action for alleged negligence. This is no longer so.

The moral to be drawn is that in no circumstances should a medical man engage in practice without being a member of one of the medical defence societies. Further, no medical man, after the warning which the profession has received by the case of Clayden *v.* Wood-Hill, need expect in any future similar case to be treated by his fellow practitioners with the generosity accorded to Dr. Wood-Hill.

A few details about the fund may be of interest to your readers:

	£	s.	d.
Total amount subscribed	1,717	4	4
Bank interest	19	13	10
	1,736	18	2
Expenses	6	5	0
Net total	1,730	13	2

A cheque for this amount has been forwarded to Dr. Wood-Hill.

The fund was made up of the following amounts:

	£	s.	d.
33 Divisions of the British Medical Association subscribed...	320	14	6
4 Branches of the British Medical Association subscribed...	66	14	10
14 Medical societies subscribed	150	17	0
14 Honorary medical staffs of hospitals subscribed	132	7	0
4 Local Medical and Panel Committees subscribed	56	19	6

Subscriptions from individuals were responsible for the remainder of the fund. The highest individual subscription was 25 guineas; the lowest 2s.

The widespread interest taken in this case is shown by the fact that subscriptions were received from such far distant places as New Zealand, Tasmania, Queensland, Toronto, Oporto, Nigeria, Khartoum, South Africa, and Baghdad.—We are, etc.,

ROBERT JONES (Liverpool).
GEORGE E. GASK (London).
R. C. ELMSLIE (London).
JOHN LYNN-THOMAS (Cardiff).
HAMILTON A. BALLANCE (Norwich).
WILSON TYSON (Lowestoft).

August 18th.

Tenth List of Subscriptions.

Amount previously acknowledged, £1,573 4s. 4d.

£30 9s. 6d.

Members of the Ipswich Local Medical and Panel Committee, per Dr. W. L. Hibbert, Hon. Sec.: Drs. Fryer, Hibbert, Pretty (second donation), J. de Staldon, Cecilia Williamson, Cameron Young, £2 2s. each. Drs. Adams, Baylor (second donation), Bellward, R. O. Eades, A. R. Hill, McKinnon, £1 1s. each. Drs. Crosswhaite, S. O. Eades (second donation), Walsh, 10s. 6d. each.

£15.

Fifteen members and four non-members of the South Middlesex Division of the British Medical Association, per Dr. T. Ruddock-West, Hon. Sec.

£11 11s.

"Some sympathisers, per J. H. P."

£10 11s. 6d.

Members of the Horsham Division of the British Medical Association, per Dr. J. W. Dew, M.C., Hon. Sec.: Drs. Matthews, Burn, Beachcroft, Kerr, Puttock, Druitt, £1 1s. each. Drs. Vernon, Kinneir, Juckes, Dew, Sparrow, Bradford, Fawkes, 10s. 6d. each. Dr. Boxall, 10s. Dr. Child, 2s.

£10 9s. 6d.

Members of the Kingston-on-Thames Division of the British Medical Association, per Dr. A. R. C. Doorly, Hon. Sec.: Drs. H. Cooper, E. G. L. Goffe, W. W. Maxwell, A. E. Evans, A. Senior, R. L. Crabb, H. E. Gray, Oswald C. S. Tandy, £1 1s. each. Drs. H. R. Cran, T. Letchworth, A. R. C. Doorly, 10s. 6d. each. Dr. C. S. Hamilton, 10s.

£8 8s.

Members of the Queenstown Branch of the South African Medical Association, per Dr. J. A. van Heerden, Hon. Sec.: Drs. Hay Michel, Grieve, Ritchie, Alabaster, de Villiers, McGregor, Arnott, Kerr Bell, Bouwer, Thomas, Gooding, Paisley, Munro, Cowen, Krige, van Heerden.

£7 17s. 6d.

Members of the West Dorset Division of the British Medical Association, per Dr. P. W. Macdonald, Chairman.

£6 10s.

Members of the Winchester Division of the British Medical Association, per Dr. Gerald A. Smythe, Hon. Sec.

£6 6s.

The Bury Division of the British Medical Association, per Dr. W. Webster Wilson, Hon. Sec.

Members of the Eastbourne Division of the British Medical Association, per Dr. William Muir-Smith, Hon. Sec.: Drs. T. Burfield (Heathfield) and W. Muir-Smith (Eastbourne), £2 2s. each. Drs. A. C. Gurney and Leslie Muir-Smith, £1 1s. each.

£6.

Members of the Southland Division, New Zealand Branch of the British Medical Association, per Dr. Stanley E. V. Brown, Hon. Sec.

£5 5s.

Drs. de Nyssen and Aylen, Halesworth.

£4 14s. 6d.

Members of the Brighton Division of the British Medical Association, per Dr. L. A. Parry, Hon. Sec.: Drs. Charles Simpson (Hove), A. H. Dodd (Hove), Donald Hall (Hove), and Walter Broadbent (Brighton), £1 1s. each. Dr. Florence Edmonds, 10s 6d.

£3 13s. 6d.

Further contribution from members of the Chichester and Worthing Division of the British Medical Association (see list published April 29th), per Dr. H. J. M. Milbank-Smith, Hon. Sec.

£3 1s.

Members of the Wiltshire Branch of the British Medical Association, per Dr. F. F. Bond, Hon. Sec.: Drs. Bond and Jones, 10s. 6d. each. Drs. Ward and Semple, 10s. each. Drs. Haydon, Vivian, Adeney, and Johnstone, 5s. each.

£2 2s.

Further contribution from members of the Rochdale Division of the British Medical Association (see list published April 29th), per Dr. James Melvin, Hon. Sec.: Drs. J. Dunlop (Rochdale) and F. W. Hartley (Heywood), £1 1s. each.

Dr. F. Fowler Ward, Ipswich.

Members of the Nottingham Division of the British Medical Association, per Mr. A. M. Webber, Hon. Sec.: Drs. C. J. Palmer (Mansfield Woodhouse) and T. J. T. Wilmot (Sutton-in-Ashfield), £1 1s. each.

£1 1s.

Dr. James A. Ainscow, Birmingham.
Mr. Clement W. Branson, Bournemouth.
Dr. J. R. Keith, Driffield.
Dr. E. L. Martin, Hull.
Dr. A. G. Osborn, Windsor.
Dr. J. W. Thomson, Nigeria.

Members of the Lewes and East Grinstead Division of the British Medical Association (Hon. Sec., Dr. H. Vallance), per Mr. L. Ferris-Scott.

Dr. St. George B. Delisle Gray, Oporto.
Dr. James W. Smith, Ryton-on-Tyne.

Further contribution from the Hartlepools Division of the British Medical Association (see list published June 3rd) (Hon. Sec., Dr. J. E. Mitchell), per Dr. Alfred Cox, O.B.E.

10s. 6d.

"S. W."
Dr. D. Kennedy, Newbury.

The Services.

STATISTICAL REPORT OF THE HEALTH OF THE NAVY FOR 1915.

THIS report was only published in 1922, the delay being due to the pressure of work on the Medical Department during the war and to the great accumulation of material since. It is, however, greatly to be deplored that the figures should not have been available before. The report covers a very interesting period of the war, when large numbers of ships were employed and the casualties from injury and disease from the Gallipoli peninsula were very heavy, though, as stated on page 168, the returns of the Expeditionary Force of the Royal Naval Division are not included.

The average strength of the total force was 236,500, the total number of cases of disease and injury was 146,805, giving a ratio of 620.73 per 1,000, a decrease of 5.72 in comparison with the average of the previous five years. The average number of men sick daily was 5,289, or 22.1 per 1,000, being 2.1 less than that of the previous five years; each person is computed to have lost 8.16 days' service for the year. The total number *finally* invalided from the service was 5,689, the invaliding ratio showing an increase of 9.26 in comparison with the average of the previous five years; but it is

pointed out that this is largely due to the fact that many of the R.N.R., R.F.R., and R.N.V.R. who had been called up in the war were found to be physically unfit. The total number of deaths was 5,216, giving a ratio of 22.05 per 1,000, which was considerably less than that of 1914; of these, 825 were due to disease, and 4,391 resulted from injury, including those killed and wounded in action; in the latter category were 834 wounds and fractures, 2,536 wounds in action, 23 burns and scalds, 922 drowned, and 33 suicides; 539 were from the *Formidable*, 511 from the *Goliath*, 196 from the *Bayano*, 127 from the *India*, 56 from the *Triumph*, 42 from the *Majestic*, 66 from the *Lynx*, and many smaller numbers from isolated ships, trawlers, etc. A full and interesting list of these casualties is given, stating the geographical position of the ship, and whether the casualties were due to torpedo, mine, or other cause.

The zymotic diseases were practically all contracted on the home station and in the Grand Fleet. Influenza is recorded in 6,235 cases, with only 4 deaths; this is a great increase of cases over that of the previous five years' average; there were also 14,400 cases of catarrh. Diphtheria caused 85 cases with 4 deaths, and cerebro-spinal fever 115 with 67 deaths—a very high mortality, probably due in part to the overcrowding of the Royal Naval Barracks at Portsmouth, Chatham, and Plymouth, which returned respectively 24, 20, and 13 cases. There were 446 cases of enteric fever, of which 62 were diagnosed as paratyphoid A and 1 as paratyphoid B, but it was often impossible to determine properly the differential diagnosis. The *Venerable* returned 32 cases among men drawn from the beach parties on the Gallipoli peninsula, the *Blenheim* 20 cases, mostly from men of the R.N.R. and R.F.R. from tenders; these were not inoculated, whereas from the ship's company there were only 2 cases. Mediterranean or undulant fever gave 27 cases, a great increase over the average of the previous five years—namely, 0.11 per 1,000 as compared with 0.04. Dysentery yielded 951 cases, of which 723 came from the Mediterranean; the majority are said to have been amœbic, and the results of emetine treatment were satisfactory. Malaria produced 1,607 cases, but only two deaths are recorded; most of the cases were of African origin, contracted on the west coast. The tuberculosis return shows a very slight decrease over the average; a specially interesting table gives the number of cases and ratio per 1,000 for the different ratings: for commissioned and warrant officers it was 1.3 to 1.5, for seamen, marines, and general hands it was 2.0 to 3.0, but for the sick berth staff it rose to 5.4 and for ship's stewards and cooks to 19.5; the reason for this requires explanation. The total number of cases of venereal disease was very high, but one reads with pleasure that there was a noticeable decrease in the case ratio per 1,000 for *each separate disease*; the highest rate was on the China station and the lowest on the Cape station; the total number of days lost to the service was 223,947. A table showing the ratio of sickness per 1,000 in the different fleets is instructive: Home 28.6, Grand 18.3, Mediterranean 24.9, West Atlantic 16.5, China 41.3, East Indies 26.3, Cape of Good Hope 29.4, Irregular 30.4. The highest ratio was found on the China station and was largely due to venereal disease; the total force was averaged at 720 men, employed in a receiving ship, a dépôt, and two sloops.

The hospitals both at home and abroad were fully occupied, and many subsidiary hospitals had to be used. The eleven hospital ships treated in all 26,614 men, of which 15,747 were military; the *Rewa*, *Somali*, and *Soudan* were employed in the eastern Mediterranean and were worked to the fullest capacity both for surgical and medical cases.

Obituary.

ARTHUR MARMADUKE SHEILD, M.B., B.CH.CAMB., F.R.C.S.,

Consulting Surgeon to St. George's Hospital.

THE announcement of the death of Arthur Marmaduke Sheild at the hotel in the Island of Colls, Hebrides, on August 5th, after a seizure on July 30th, recalls a striking personality and the disappointment of that full measure of success which was confidently anticipated for him when ill health necessitated his premature retirement in 1907. He was born in 1858 at Landawke, Lougharne, Carmarthen, and was the son of William Henry Sheild of Gilfach, Pembrokeshire. He was educated privately, and entered the medical school of St. George's Hospital in 1875; he had a most distinguished career as a student, winning the Brackenbury prize in surgery and the William Brown (£40) exhibition in 1878, and the William Brown (£100) exhibition in the following year, when he took the M.R.C.S. and L.R.C.P. and became house-surgeon. In 1881 an important event in his life occurred, for he obtained the appointment of house-surgeon at Addenbrooke's Hospital, Cambridge, and thus came under the influence of that great teacher, Sir George Humphry, whom he assisted in private and in many respects resembled. His three years at Cambridge left their impress on his shrewd character and gave him a university experience and degree, for he was contemporaneously, as was then possible, an undergraduate at Downing College. In 1883 he achieved the feat of passing the two parts of the F.R.C.S. in the same month, and in 1884 he returned as resident obstetric assistant to St. George's, where he was also anæsthetist and in 1886 curator of the museum, a recognized step to the staff. In the same year, however, he was attracted away as assistant surgeon to the Westminster Hospital, but soon after migrated to Charing Cross Hospital, where for the next seven years he was assistant surgeon, aural surgeon, demonstrator of anatomy, and lecturer on practical surgery in the medical school. At this period of his career he was associated with the late Dr. Montague Murray as a private coach, many men up for the surgical examinations passing through his hands, and was busily engaged in many other directions. In June, 1893, he was called back to St. George's as assistant surgeon, becoming later (1895) surgeon to the throat department, and in 1900 full surgeon. He held also the posts of surgeon to the Waterloo Road Hospital for Women and Children, and to the Hospital of SS. John and Elizabeth, and was secretary of the Medical Society of London, the old Dermatological Society, and of the Surgical Section of the British Medical Association at its annual meeting in London in 1895. He was also an additional examiner in surgery at his old university and an examiner at the Apothecaries' Society. In 1907 he had the terrible experience of inoculating himself during an operation, and his health was so gravely affected that he was obliged to give up work, at the age of 49, and to retire to the country. After a long illness, necessitating many operations, his health improved, and during the war he gave his services as consulting and operating surgeon to a military hospital at Exmouth, near Budleigh Salterton, where he had settled down.

Sheild's literary output corresponded with his all-round activities and bore witness to his ability as a general surgeon with special knowledge in oto-laryngology and dermatology. His efficiency in these special departments was shown by his books on *Diseases of the Ear* (1894), his *Lectures on Nasal Obstruction*, and the articles in the first edition of Allbutt's *System of Medicine* on diseases of the nails and tumours of the skin; his contribution on dislocations and joint injuries to Treves's *System of Surgery* and on diseases of the breast to Quain's *Dictionary of Medicine* prove that he was regarded as a prominent general surgeon. He also published a volume of *Surgical Lectures and Essays*, but his chief work, embodying observations and collection of cases over many years, was *A Clinical Treatise on Diseases of the Breast*, which appeared in 1898 and was a well-balanced, practical, and up-to-date account of this important and extensive subject.

His wide experience made Sheild a popular and most successful teacher of students; he was above all things practical, and, besides insisting on the principles of surgery, laid stress on matter that would eventually prove of importance in private work. His method of instruction was arresting and impressive, like that of his old teacher Sir George Humphry, and his fund of humour and anecdote was often utilized to drive home his points and, indeed, rendered them difficult to forget.

A man of strong and independent character, he was no respecter of persons, certainly never sought favour by knuckling under to seniors, and had fearlessly fought his way up by his unaided efforts. In spite of some adverse conditions, among which must be reckoned threatened tuberculosis in early professional life, the struggle was successful, but he emerged a watchful and resourceful opponent in debate and often appeared somewhat cynical, and so hid his real kindliness of heart. His brilliant conversation and power of mimicry rendered him welcome socially, and he had close friends; but these gifts made others, possibly with reason, look uneasily to the weak points in their armour and wonder what comments they might excite. Apart from his profession he had many interests: he was devoted to fishing, played golf, and had an intense love of the country, to which he always intended to retire long before his full time at the hospital was run. As it was, an evil fate determined that this should occur prematurely, and his career, interesting from its high promise and achievements, rather sadly illustrates the changes and chances that may beset a consulting surgeon.

H. R.

WILLIAM THOMAS, F.R.C.S.,

Birmingham.

BY the death of Mr. William Thomas of Birmingham the medical profession of that city loses one of its oldest and most esteemed members. He was the son of Dr. Robert Thomas, and was born near Leeds in 1840; he entered Queen's College, Birmingham, as a medical student in 1862, and had a very distinguished career. In 1865 he obtained

the diplomas of L.S.A. and M.R.C.S.Eng. He then held the post of resident medical officer to the Bradford Infirmary, where he remained for two years, and on returning to Birmingham he took the M.B.Lond. in 1867 and the F.R.C.S.Eng. in 1869.

He was professor of anatomy at Queen's College, Birmingham, from 1874 to 1884, being given the title of emeritus professor on his retirement from the chair. He was pathologist to the Queen's Hospital from 1874 to 1878, surgeon to the Children's Hospital from 1874 to 1894, and surgeon to the Orthopaedic and Spinal Hospital from 1883 to 1908; to both of the last-named institutions he remained a consulting surgeon up to the time of his death. In 1888 he was appointed Ingleby lecturer for the year. He was a past-president of the Midland Medical Society, and his contributions to medical literature were numerous and important. He is survived by his widow, three sons, and two daughters.

DR. WILLIAM BLACK ALEXANDER died in a nursing home in Edinburgh on August 18th at the age of 78. He was educated at the Edinburgh Institution and University and took the diploma of L.R.F.P.S.Glasg. in 1869, and carried on a large practice in Edinburgh for forty years. He was also for many years a district medical officer under the Edinburgh Parish Council, and since 1911 surgeon apothecary to H.M. Household at Holyrood Palace. At one time Dr. Alexander was physician to the City Fever Hospital. He was elected a Fellow of the Edinburgh Obstetrical Society in 1882. His favourite recreation was golf, which in his earlier days he played with enthusiasm. Dr. Alexander's wife died some twelve years ago; one of his four sons is medical superintendent of the Aberdeen City District Asylum.

Universities and Colleges.

UNIVERSITY OF LONDON.

UNIVERSITY COLLEGE HOSPITAL MEDICAL SCHOOL.

THE Goldsmid Entrance Exhibitions, 1922, of one hundred and twelve guineas each, have been awarded to Mr. P. M. D'Arcy Hart and Miss Janet Vaughan.

ROYAL COLLEGE OF SURGEONS IN IRELAND.

THE following candidates have been approved at the examinations indicated:

Primary Fellowship Examination.—R. F. J. Henry, Lucy M. Joly, A. J. Mooney, A. Ff. O'Carroll, R. W. Power, F. H. Whyte, W. K. C. Wynne.

Final Professional Examination.—C. D. Dykman, H. O. Mackey, S. A. McSwiney.

CONJOINT BOARD IN IRELAND.

THE following candidates have passed the examination indicated:

Final Fellowship Examination.—Henrietta C. Ball, J. T. Barrett, H. T. Beggs, S. S. Brass, Mary F. J. Connolly, E. M. Dodd, P. Fleming, J. A. Flynn, P. J. Greene, V. E. Lee, M. Levy, J. J. A. Loftus, D. S. Magner, Gladys C. M. Marshall, J. S. Matthews, M. P. Moran, Maggie M. Nelson, J. F. O'Connell, The O'Rourke, F. E. Preston, W. E. Rutledge, W. Sherowitz, R. T. Taylor.

Medical News.

THE King has appointed Mr. John Herbert Gibbs, F.R.C.S.Edin., to be Honorary Surgeon Dentist to His Majesty in Scotland.

THE Mayor of Weymouth, on August 17th, unveiled a bust of Dr. James Macpherson Lawrie, until recently senior physician to the Princess Christian Hospital, Weymouth, which has been presented to the hospital by a committee formed to commemorate Dr. Lawrie's great services to the hospital. It was originally founded by Dr. W. J. Smith for the treatment of diseases of women and children; through Dr. Lawrie's exertions it was rebuilt on a more appropriate site; a short time ago it was amalgamated with the other hospital in the town, the Royal Hospital. The bust was accepted on behalf of the hospital by Mr. Watts, chairman of the Hospital Committee. Dr. Du Boulay, at present senior surgeon to the hospital, expressed the pleasure of the medical staff and of the profession in Weymouth when they heard of the proposal, and the gratification with which they witnessed its realization. Dr. Lawrie, in acknowledging the compliment, said that he was glad to know that his bust would in future stand opposite that of Dr. Smith, the original founder of the hospital, a very exceptional man and one of his own best friends.

THE vacation course in general medicine, arranged by the Fellowship of Medicine, will begin on Monday, September 11th, and continue daily for two weeks until September 22nd. Copies of the syllabus and other information can be obtained on application to the Secretary to the Fellowship of Medicine at No. 1, Wimpole Street, London, W.1. A short comprehensive course on tropical diseases will be given at the School of Tropical Medicine, Endsleigh Gardens, N.W.1, during October. Copies of the preliminary syllabus are now ready and further details as to days and hours will be published shortly. Those desiring to attend the course should notify the Secretary to the Fellowship of Medicine as soon as possible.

AN Australian and New Zealand Medical Association in England has been founded to assist medical visitors to this country with information and, if it be desired, with advice. The Association is open to all medical graduates or undergraduates born in Australia or New Zealand and resident in or visiting England. The fee is one payment of 5s. Further information can be obtained from the honorary secretaries, Mr. E. T. C. Milligan, F.R.C.S., and Mr. Bedford Russell, F.R.C.S., 86, Harley Street, London, W.1.

COURSES of instruction in the diagnosis and treatment of fevers will be given at seven of the hospitals of the Metropolitan Asylums Board during October, November, and December. The fee for a two months' course is £3 3s., and for three months £4 4s. A three months' course of lectures and demonstrations on hospital administration will be given at the North-Western Hospital, Hampstead, by the medical superintendent, Dr. E. W. Goodall, on Mondays and Thursdays, at 5.15 p.m., commencing on Monday, October 2nd; the fee for the course is £3 3s. A two months' course of instruction in the diagnosis and treatment of fevers by the medical superintendent, Dr. F. M. Turner, will commence on Friday, November 3rd, at 11 a.m., and be continued on succeeding Tuesdays and Fridays; the fee is £3 3s. for the course. Further particulars can be obtained from the clerk of the Metropolitan Asylums Board, Embankment, E.C.4.

THE Ministry of Health has sent a circular to Poor Law authorities, transmitting a memorandum explaining the application of the Dangerous Drugs Act, 1921, to Poor Law institutions. The regulations made apply to the use of cocaine, heroin, opium, and their salts and preparations, but certain named preparations and prescriptions containing them are exempted. The medical officer of a Poor Law institution is required to sign all orders for these drugs, and to sign or initial all prescriptions containing them; he is further required to take all necessary precautions to ensure the safe delivery of the drugs, and is required to keep certain records concerning them.

A CIRCULAR has been issued by the medical department of the Board of Education with regard to the conditions under which minor dental work may be performed in connexion with the school medical service, by persons who are not registered dentists. The work must be performed under the personal supervision of a registered dentist, and must be limited to cleaning or polishing teeth, removing dressings or temporary fillings, and keeping records. The person concerned must be either a dental student who has received an approved degree of training (and who may be employed for not more than six months), a dental nurse of approved training, or a person already employed under arrangements previously approved. The registered dentist under whose personal supervision the work is performed must always be present when operative work is being done, must supervise a limited number of persons only, and must prescribe and be responsible for the treatment carried out.

THE Guild of St. Luke was founded in 1864, its object being the mutual encouragement and support of medical practitioners and medical students in leading a Christian life by communion, prayer, personal influence and example, and the promotion of works of mercy. It consists of students and practitioners of medicine, men and women, who are communicants of the Church of England or of any church in communion with it. The provost of the council of the guild is Mr. George Cowell, and a London hospitals' branch of the guild has been founded, with Mr. Raymond Johnson as master. The guild desires to appeal specially to medical students, by whom and for whom it was founded. The entrance fee is one shilling and the annual subscription not less than half a crown and not more than a guinea; further particulars may be had from the secretary, the Rev. H. Kirkland-Whittaker, M.D., Chaplain's House, Banstead Downs, Sutton, Surrey, or from the secretary of the Women's Ward, Dr. Isabel Pulteney, 2, Bryanston Place, W.1.

THE *Times* announces that the Quebec Government has decided to set apart 100,000 dollars (about £22,000) for the purpose of establishing a radium institute, under the control of the University of Montreal, for the experimental treatment of cancer.

Letters, Notes, and Answers.

As, owing to printing difficulties, the JOURNAL *must be sent to press earlier than hitherto, it is essential that communications intended for the current issue should be received by the first post on Tuesday, and lengthy documents on Monday.*

ORIGINAL ARTICLES and LETTERS *forwarded for publication are understood to be offered to the* BRITISH MEDICAL JOURNAL *alone unless the contrary be stated.*

CORRESPONDENTS who wish notice to be taken of their communications should authenticate them with their names—of course not necessarily for publication.

AUTHORS desiring reprints of their articles published in the BRITISH MEDICAL JOURNAL are requested to communicate with the Office, 429, Strand, W.C.2, on receipt of proof.

IN order to avoid delay, it is particularly requested that ALL letters on the editorial business of the JOURNAL be addressed to the Editor at the Office of the JOURNAL.

THE postal address of the BRITISH MEDICAL ASSOCIATION and BRITISH MEDICAL JOURNAL is 429, Strand, London, W.C.2. The telegraphic addresses are:

1. EDITOR of the BRITISH MEDICAL JOURNAL, *Aitiology, Westrand, London;* telephone, 2630, Gerrard.
2. FINANCIAL SECRETARY AND BUSINESS MANAGER (Advertisements, etc.), *Articulate, Westrand, London;* telephone, 2630, Gerrard.
3. MEDICAL SECRETARY, *Mediocra, Westrand, London;* telephone, 2630, Gerrard.

The address of the Irish Office of the British Medical Association is 16, South Frederick Street, Dublin (telegrams: *Bacillus, Dublin;* telephone, 4737, Dublin), and of the Scottish Office, 6, Rutland Square, Edinburgh (telegrams: *Associate, Edinburgh;* telephone, 4361, Central).

QUERIES AND ANSWERS.

DANGER TO THE CHILD IN "TWILIGHT SLEEP."

DR. SYDNEY A. WINSTANLEY (Urmston, Lancs) writes in reply to Dr. H. D. O'Sullivan (August 12th, p. 288): "Out of a series of 239 cases in the last five years, I have not known any case in which 'twilight sleep' has endangered the child. There was only one stillborn child in the series. This was an impacted breech presentation, in which there was great difficulty in delivery. One child with congenital heart disease died after living twenty-four days. The remainder were all healthy children when I ceased to attend. Thirty-four cases were conducted in nursing homes, 6 in my own house, and the remaining 199 in the patients' own homes. Nearly half the cases were terminated by forceps, and in about half of these a general anaesthetic ($CHCl_3$) was given in order to keep the mother still. A few, perhaps fifteen, of the babies required some artificial respiration, but only one caused any real anxiety. This was an eight months premature baby; it eventually survived, and is now a healthy boy. In no case did the mother feel any pain or remember anything which occurred more than twenty minutes after the first injection. I would advise Dr. O'Sullivan to omit the use of morphine if he can expect the child to be born within 1½ hours of the first injection. It is in these cases that I have generally found the child needs some artificial respiration or stimulation before it cries lustily. In such cases a few drops of $CHCl_3$ given with each of the early pains will take the place of the morphine and will greatly aid the scopolamine in its action."

INCOME TAX.

"W.B." is a district medical officer to a parish council (part-time)—under condition that he resides and has a consulting room in his district. What allowances can he claim?

*** He can claim an allowance not only for a proportional part of the rent—on any reasonable basis—but also for similar proportions of rates, lighting and heating, cleaning, and other general expenses.

"W. E. B." inquires whether he can legally claim an allowance for depreciation on an *x*-ray transformer.

*** No; that mode of allowance cannot legally be extended to the case of professional earnings. "W. E. B.," however, should bear in mind that he can claim a deduction for the expense of maintaining the *x*-ray equipment by replacements from time to time.

"J. W. E. O." bought a practice which had deteriorated in his predecessor's hands. It had been assessed to tax at £300, but the current year's working should show a larger profit than that.

*** Our correspondent is entitled to assessment on the basis of the three previous years, but unfortunately has not complete evidence as to what those earnings were. We suggest that he get together what figures he can showing the probable gross receipts and expenses of his predecessor—the amount paid for the practice would be some evidence as to receipts—and see the local inspector with the statements. It seems to be a case where an amicable settlement should be possible.

"S. R. P." expects to be in the United Kingdom from May 18th to November 17th, 1922—that is, 185 days, but less than six calendar months. Will he be liable for British income tax?

*** In our opinion, No; unless he establishes a residence here.

"L. H." asks (1) whether the three years' average still applies to 1922-23, and (2) inquires as to the allowance due to him for a car renewal.

*** (1) Yes, except to the earnings of an "employment," which are now assessable on the amount of the salary, etc., for the current year; (2) apparently the car purchased is of a superior quality and the amount of the allowable expense is therefore the 1921 cost of the old car less £330, the amount allowed for it.

LETTERS, NOTES, ETC.

WE anatomists, said Méry, are like the porters of Paris, who know every street but nothing of what goes on inside the houses.

INFECTIVITY OF ARTIFICIAL DENTURES.

MR. F. TALBOT (Highgate, N.) writes: Mr. J. H. Badcock's advice (July 22nd, p. 150) as to the care of dentures is undoubtedly salutary, but it fails to make sufficient allowance for human frailty—perhaps one ought to say, for the decencies of social life. Before the tribunal of hygiene the wearing of artificial dentures at night is quite indefensible; but it will infallibly be practised by people who are very sensitive about their appearance. Mr. Badcock denounces this motive as vanity, but it might sometimes fairly be called refinement of feeling. I venture to suggest a practicable compromise. On retiring to bed replace the dentures, after they and the mouth have been thoroughly cleansed in the way Mr. Badcock suggests. Now, few people who are of an age to require artificial teeth sleep uninterruptedly throughout the night. At the first opportunity, then, let the dentures be removed and deposited in a metal box of platinum encrusted with jewels, of gold, silver, or aluminium, according to the means of the patient, which can be silently closed and secreted under the pillow. Or, still better, let them be placed in a little china toilet-box containing a mild antiseptic fluid and standing at the bedside. They can be reinserted at the first approach of dawn, the rosy-fingered. Then, in recommending that the gums should be thoroughly brushed, Mr. Badcock, I think, overlooks the fact that patients cannot be trusted to sterilize their toothbrushes, and are consequently liable to inoculate their gums with a prolific bacterial flora. I suggest the use of a rubber brush which can be kept permanently, except when in actual use, in antiseptic solution; or more simply, perhaps, the gums may be thoroughly massaged with the forefinger protected by a finger-stall, lubricated with a soft tooth-paste or dentifrice containing potassium chlorate. For the purposes of this discussion I am disregarding the undoubted danger contingent upon the wearing of small and insecure dentures during sleep.

CAESAREAN SECTION.

DR. C. M. CRAIG (Kendal) writes: The correspondence on Caesarean section in your recent issues makes melancholy reading, and I wonder—doubtless along with many others—why you allow such fireside effusions to be printed in the JOURNAL. I have never had the misfortune to read in the JOURNAL a more childish letter, and one in worse taste, than the letter which appears over the signature of James H. Martin, July 22nd date. Only a month past I assisted a colleague, a general practitioner, to perform Caesarean section in two urgent cases. He employed an incision through the rectal sheath, right side in one case, left side in the other. The uterus was likewise everted to facilitate removal of membranes, and the patients were nursed in the Fowler position. Let me add both did well. My colleague, so far as I can tell, does not suffer from the delusion that he was original in his methods, and I can guarantee that the fame of Dr. J. H. Martin had not reached him. I really think, Mr. Editor, you do owe us an apology for publishing such correspondence.

VACANCIES.

NOTIFICATIONS of offices vacant in universities, medical colleges, and of vacant resident and other appointments at hospitals, will be found at pages 25, 26, 27, 30, 31, and 32 of our advertisement columns, and advertisements as to partnerships, assistantships, and locumtenencies at pages 28, 29, and 30.

A short summary of vacant posts notified in the advertisement columns appears in the *Supplement* at page *100*.

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